

THE DEVELOPMENT OF THE PERCEPTION
OF AMBIGUITY

BY

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For Phil--the closer the better

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Sixty-nine white, native-English speakers between the ages of eight and twelve years old were tested through picture-verification in five related designs to determine at what age they could perceive deep-structure ambiguity. The subjects heard ten ambiguous sentences and twenty unambiguous sentences. The unambiguous sentences consisted of two sentences for each ambiguous sentence, each conveying one of the meanings of the ambiguous sentence. Subjects chose pictures to indicate which meanings they perceived. It was expected that the subjects would choose one picture for each unambiguous sentence and, when they perceived the ambiguity, choose two pictures for the ambiguous sentences. However, the subjects consistently chose more than one picture for both the ambiguous and unambiguous sentences, indicating that to them all of the sentences were ambiguous.

Because most of the test sentences were composed of a derived nominal, some form of the verb be, and an adjective, it was felt that the problems were related either to the verb be, itself, or to the plural marker which disambiguated the nominal. A second test was designed in which twenty-four sentences, twelve ambiguous and twelve unambiguous, were presented to 130 subjects between the ages of 7 and 12, and to 53 subjects between 18 and 29. These sentences consisted of an ambiguous nominal, a subject nominal, or an object nominal followed by either is and are or looks and look followed by an adjective. The subjects were asked to circle the correct form of the verb. For the ambiguous sentences, either form was correct. For the subject nominal the plural form was correct, and for the object nominal the singular form was correct. It was concluded that subject/verb agreement in the context of derived nominals is not fully acquired by the age of 12 years. This finding was presented as an explanation for the inability of the subjects in the first experiment to disambiguate the nominal and thus perceive that twenty of the original test sentences were unambiguous.

CHAPTER I

INTRODUCTION

Attempts to understand how a child learns to speak his native language have produced numerous anecdotal descriptions of the child's linguistic behavior. However, systematic descriptions of the child's acquisition processes are still quite limited. We know the sequences of certain elements as they appear during the first five years of the child's life. But as the child grows older, he gains more subtle aspects of his language. These more subtle aspects include various complexities of sentence structure which the child learns to comprehend and produce. The relationship between two sentences which are similar in meaning and in structure can be described with the use of transformations within the context of Transformational Grammar. The Passive Transformation, for example, states the structural relationship between sentences 1.a. and 1.b.

1.a. Sam Peckinpah directed that movie.

1.b. That movie was directed by Sam Peckinpah.

Although these sentences share basically the same meaning, their structures are quite different. As part of the process of acquiring language, a child must learn those things about sentence structure which transformations explain.¹ Through various testing methods, we are able to determine that by a certain age most normal children have a specific transformation

in their grammars. For example, by the age of nine years most children have acquired Dative Movement, a rule which allows the child to comprehend that sentences l.c. and l.d. have the same meaning (Scholes, Tanis, and Turner 1976).

l.c. Tom showed the dog to the little boy.

l.d. Tom showed the little boy the dog.

The number of grammatical structures which a child must acquire is quite large, but the number for which we know the age of acquisition is quite small. It is important that we be able to say when a certain structure is acquired.

One reason for this importance is that this information provides a guideline for comparing languages. We know that native speakers of English acquire transformations in a fixed sequence. Presumably there is a fixed sequence for each language. Although different languages employ a variety of different rules, there is an overlap in their use. For example, many languages employ a plural marker to indicate that there is a difference between nouns in the singular and nouns in the plural. The native English-speaking child acquires the plural morpheme by the age of four years. The speakers of Egyptian Arabic do not master the rules of plural formation before the age of fifteen years (Omar 1970, quoted in Slobin 1973). Such a comparison offers us insight into the similarities and differences which exist among languages. Obviously, in this case there is a vast difference in the complexity of the rules for plural formation in English and

those for Egyptian Arabic. If enough information about the acquisitional sequences for different languages were available, it would be possible to determine whether there is a trend across languages toward a universal sequence of acquisition.

Secondly, because language development is highly correlated with intellectual development, a knowledge of the order and age of acquisition of transformations would provide a basis for determining a child's developmental progress. This is true among normal children, but it would also give us a reference point for studying people who are deaf or retarded or brain-damaged or who have undergone a hemispherectomy or are abnormal in some other respect which is related to linguistic development.

For those people who believe that the dissolution of language (as with aphasia) follows somewhat the reverse order of language acquisition, the knowledge of this sequence would improve the chances for proving or disproving this belief.

A fourth reason for knowing the age of acquisition of certain transformations is that for people who design tests such as reading and IQ tests, it would be far more consistent to test children's abilities in those areas of which they are able to comprehend the content. In other words, a child may perform poorly on a test because he does not understand the syntax in the instructions or in some material which he has to read. Consequently, it may appear that the child cannot perform a particular task when, in fact, he may be quite

capable, but he simply does not comprehend other information that he needs in order to complete the task. The problem is not limited to children. A student may be asked to read an article and then to draw a particular conclusion. He may reach the wrong conclusion, not because of faulty logic or because of an inability to read, but rather because the syntax of the article is too complex for him.

A specific example has occurred in the Writing Laboratory at the University of Florida.² Students in the Writing Laboratory are tested in their ability to recognize sentence errors.³ On one test the students were instructed to find the incorrect sentence from a group of three sentences. The following sentences are two of a set of three sentences from this test:

1.e. A wide range of choices is offered students by educators experimenting with new programs.

1.f. Experimenting with new programs, a wide range of choices is offered college students.

Sentence 1.f. is considered grammatically incorrect because the introductory clause is a so-called 'dangling modifier.' However, sentence 1.e., although technically correct, is syntactically difficult to the students in the Writing Laboratory. The first clause is passive, the to which is the overt marker of the dative has been deleted, and the indication that experimenting is derived from a relative clause is also missing. This syntactic complexity led many of the students to choose sentence 1.e. as the incorrect sentence.

On another test in the Writing Laboratory the students were instructed to identify the errors in the sentences on the test. They were told that there would be either sentence fragments, run-on sentences, sentences which lack parallel structure, or sentences with no errors. One of the items on the test is listed here as l.g.

l.g. Although the life-support system was defective, the problem was discovered too late. Fearing money for the space program will end if there is a scandal.

The clause 'Fearing money for the space program will end if there is a scandal' is a sentence fragment. Many of the students in the Writing Laboratory had considerable trouble with this item on the test because it made absolutely no sense to them. One student claimed that the clause was a complete sentence with fearing money as the subject of the verb will end rather than money as the subject of will end. From a purely syntactic point of view, this interpretation is possible. However, no sentence content corresponds to such a syntactic structure, a fact which did not bother the student because she was unable to make sense out of it in any other way. The meaning of this clause would have been much clearer had there been a that complementizer between fearing and money. Adding that would not have altered the fact that this clause is a sentence fragment, but it would have helped the students in their understanding of this item. The point is that the students' performance on this item was meant to indicate that

they could not recognize sentence fragments, when, in fact, the problem was one of unnecessarily complex syntax. Had syntactic complexity been taken into consideration, the test would have been more valid. This sort of problem should be avoided by people who design tests.

If it is in fact the case that different dialects of the same language have different rules or different ordering of rules or that their speakers acquire some transformations in different orders, then this information would be important for the following reasons:

1. As a basis for descriptive comparison.
2. If transformation X is acquired at the age of 7 in one dialect, but not until the age of 9 in another dialect, then this should be recognized as a dialect difference and not, for example, as an indication of retardation.
3. Aphasics of one dialect may possibly produce different behavior from aphasics of another dialect; that is, dissolution might follow a different sequence depending on the aphasic's dialect.
4. Tests should be designed so as to avoid a bias in favor of or against a particular dialect.

These four reasons are the same as the first four major reasons but are applied here specifically to dialects.

Finding the age of acquisition of particular abilities is simply one more aspect of the challenge that Noam Chomsky

set forth when he said, 'As a long-range task for general linguistics, we might set the problem of developing an account of this innate linguistic theory that provides a basis for language learning' (1965:25). And an understanding or knowledge of 'this innate linguistic theory' which a child uses in order to acquire his native language would provide a further understanding of the relationship of language to other mental faculties. An understanding of the nature of the child's internal grammar would provide a view into other aspects of the mind. Since, as Chomsky put it, 'An actual language may result only from the interaction of several mental faculties, one being the faculty of language' (1975: 43), an increase in the understanding of one offers better understanding of others.

It is for these reasons that we continue to search for a systematic description of the processes which are involved in language acquisition.

With these ideas in mind, I set out to determine at what age the normal, white, native English-speaking child acquires the ability to perceive that a sentence is ambiguous at the level of the deep structure. Ambiguity, the presence of more than one meaning, is generally divided into three main categories.

1. Lexical ambiguity--when a single word or lexical item has more than one meaning. In the sentence 'The young boy was sitting by the bank' the word bank may mean either a building where people keep money or it may mean the edge of a river.

2. Surface-structure ambiguity--when different meanings can result depending on the way in which the words in the sentence are grouped. Surface-structure ambiguity, also known as surface-bracketing ambiguity, is defined by Fodor, Bever, and Garrett (1974:95) as ambiguity for which there are 'alternative constituent structure analyses.' For example, the meaning of the sentence 'They are visiting relatives' depends on whether the words are visiting are grouped as a single constituent or whether the words visiting relatives are grouped as a single constituent. The meanings of this sentence 'can be represented by reference to alternative bracketings' (Fodor, Bever, Garrett 1974:95) of the elements of the sentence:

1.h. They (are visiting) relatives.

1.i. They are (visiting relatives).

3. Deep-structure ambiguity--when two different deep structures undergo transformations which give them identical surface structures. It is not possible to bracket constituents of sentences which are ambiguous at the deep-structure level in order to represent the differences in structure or meaning. Consider the sentence 'The police stopped drinking on campus.' In this sentence, it is the subject of drinking which is ambiguous. In the deep structure there are different subjects for drinking, but in the surface structure those subjects have been deleted by transformations. For the meaning which is equivalent to 'The police quit drinking on campus,' the subject of drinking was deleted by Equivalent Noun Phrase Deletion Transformation (also known as Equi NP Deletion or,

simply, as Equi). This transformation applies when the subject of the main clause is also the subject of a gerund or an infinitive. It functions to delete the subject of that gerund or infinitive. For the meaning which is equivalent to 'The police ended drinking on campus,' the subject was deleted by Pro Deletion Transformation. This transformation applies when the subject of a gerund or an infinitive is an unspecified NP in the deep structure. Its function is to delete the subject of that infinitive or gerund.

A behavioral difference between surface-structure ambiguities and deep-structure ambiguities is that for the former there is a difference in intonation patterns depending on the meaning, whereas, for the latter, the intonation pattern remains constant regardless of meaning. The sentence 'They are flying planes' is a surface-structure ambiguity because it can be explained in terms of bracketing:

1.j. They (are flying) planes.

1.k. They are (flying planes).

Such a sentence can be disambiguated with an intonation pattern comparable to the bracketing:

1.l. They are flying planes.

1.m. They are flying planes.

However, a sentence such as 'They want to stop smoking' cannot be disambiguated through an intonation pattern. In order for a person to perceive both meanings of a deep-structure ambiguity, he must be able to comprehend the structures which correspond to each meaning. In the case of 'They want to stop smoking,'

the structure which corresponds to 'They want to quit smoking' in which they is the subject of smoking is derived through Equi NP Deletion. The ability to comprehend this particular meaning depends on the ability to understand a structure which is produced through Equi NP Deletion Transformation. Similarly, the structure which corresponds to 'They want to prevent smoking,' in which the subject of smoking is an unidentified or unspecified element comparable to someone or others, has been derived through Pro Deletion Transformation. The comprehension of this meaning is contingent on the ability to understand the structure of a sentence which is derived through Pro Deletion Transformation. Consequently, the ability to perceive the ambiguity of this sentence is based on the ability to comprehend the structures for both meanings. Thus a child could not perceive both meanings of a deep-structure ambiguity unless he had acquired both transformations which are necessary for the two meanings.

The age at which a child becomes capable of perceiving deep-structure ambiguity should be predictable on the basis of the age of acquisition of the transformations which are required to generate the structures that correspond to both meanings. For example, if a child acquires the ability to comprehend Equi NP Deletion Transformation by the age of 4 years, but acquires Pro Deletion Transformation at the age of 9 years, then beginning only at the age of 9 years should he be able to perceive the ambiguity of a sentence such as 'They want to stop smoking.' This prediction is based on the

assumption that perception of deep-structure ambiguity is determined by the ability to comprehend relevant transformations and by cognitive capacities that are developed prior to or at the same time as these transformations. If any such cognitive capacities are necessary for the perception of ambiguity but have not been developed by the time that these relevant transformations are acquired, then the transformations, themselves, would not be sufficient for the perception of the ambiguity.

The assumption that the perception of deep-structure ambiguity is determined by the ability to comprehend the relevant transformations was the subject of this investigation. The only other study which has investigated ambiguity from a developmental standpoint was done by Frank Kessel (1970). Kessel tested fifty children from kindergarten through fifth grade (with the exception of the fourth grade) in their ability to perceive lexical ambiguity, surface-structure ambiguity, and deep-structure ambiguity.

In his study, subjects were asked to choose the picture or pictures which represented the sentences which the experimenter read. The subjects heard twelve sentences, four for each type of ambiguity. The four sentences with deep-structure ambiguity which Kessel presented to his subjects were:

- 1.n. The eating of the chicken was sloppy.
- 1.o. She hit the man with glasses.
- 1.p. The visiting of the doctor was happening.
- 1.q. The shooting of the soldier was bad. (p. 26)

Kessel found that 'only after the age of 10 do children consistently and spontaneously (without "lead-in" questions) detect both meanings in surface and underlying structure ambiguities' (p. 43). He made no attempt to determine or explain what factors contribute to the acquisition of the ability to perceive ambiguity.

Notes

¹Whether a child actually acquires transformations or whether transformations are, more appropriately, devices to describe linguistic facts is still up for debate. For the purpose of this paper, when I discuss the processes involved in 'acquiring a transformation,' I am aware of the problems which this phrase implies, but I will use this terminology for the sake of simplicity.

²The Writing Laboratory is a one-credit course offered by the Reading and Writing Center at the University of Florida. It is designed to help students with such basic writing skills as paragraph development and grammar.

³These examples are used by permission of The Writing Laboratory. The tests from which these sentences were taken are not professionally designed, standardized tests. They were, instead, written within the Writing Laboratory of the University of Florida and, like any tests which are designed by a classroom teacher, are likely to contain errors in validity and reliability.

CHAPTER II

EXPERIMENTS_I THROUGH V

Unlike Kessel's study, this investigation attempted to predict perception of deep-structure ambiguity on the basis of linguistic theory of transformations. This study attempted to show that a child's ability to detect deep-structure ambiguity can be predicted by his ability to handle certain transformations. Only after a child has acquired the transformations which are necessary to generate both meanings of an ambiguous sentence, should he be able to comprehend both meanings of that sentence.

This hypothesis was tested by presenting students with sentences which were ambiguous at the deep-structure level. For every ambiguous sentence there were two unambiguous sentences, one for each of the meanings of the ambiguous sentences. Not only did the unambiguous sentences convey the same meanings as the ambiguous sentence, but they also had the same syntactic structures which corresponded to the meanings of the ambiguous sentence. The purpose of this paradigm was to predict behavior on the ambiguous sentences by performance on the unambiguous sentences which corresponded to it. Consider the following three sentences:

- 2.a. Flying planes can be dangerous.
- 2.b. Flying planes is dangerous.
- 2.c. Flying planes are dangerous.

Sentence 2.a., which is ambiguous, contains the meanings expressed in sentences 2.b. and 2.c. Sentence 2.b. contains a nominal which can be described as an object nominal and which can be paraphrased as 'the act of flying planes.' The entire nominal flying planes is the subject of this sentence. Sentence 2.c., on the other hand, contains a subject nominal which can be paraphrased as 'planes which are flying.' Since flying functions as an adjective in sentence 2.c., only the noun planes is the subject of the sentence.

The task which the subjects were asked to perform was to indicate which picture or pictures corresponded to the sentence which the experimenter read. The prediction was that the students would choose the correct picture for each of the unambiguous sentences, thus indicating their comprehension of these sentences and their structures, if they were to choose the correct pictures for the ambiguous sentence. In other words, the student should perform correctly on sentences 2.b. and 2.c. if he is to get 2.a. correct.

Experiment I

Method

Subjects. Forty-seven students were selected from P.K. Yonge Laboratory School in Gainesville, Florida. There were four groups of males and four groups of females, ranging from 8 through 11 years of age. Because of a suspected difference in dialect, there were no black students included in the study. All of the students were native speakers of English.

Apparatus. The test design included five pretest sentences, used to establish that the subjects could handle the task of pointing to one or more than one picture for each sentence that was read, and thirty test sentences, composed of ten ambiguous sentences and twenty unambiguous sentences. A list of these thirty-five sentences appears in Appendix A. The twenty unambiguous sentences consisted of two interpretations for each ambiguous sentence. The criteria for the ambiguous sentences were that they be deep-structure ambiguities, that the intonation pattern be the same regardless of meaning, and that they be representable with drawings.

Of the ten ambiguous sentences, seven had as their structure nominal phrase + can be + adjective, for example, 'Visiting relatives can be boring.' The unambiguous interpretations of these seven sentences were made up of the same nominal phrase, either the verb is or the verb are, and an adjective. Thus the two interpretations for 'Visiting relatives can be boring' were 'Visiting relatives is boring' and 'Visiting relatives are boring.' These last two sentences were not ambiguous because the verb determined whether the nominal was to be interpreted as a subject nominal or an object nominal. The original sentence 'Visiting relatives can be boring' is ambiguous because there is no overt marking for number on the verb can be.

It was also important that the adjectives in these sentences be appropriate to either interpretation of the nominal. Hence, both the act of visiting relatives and relatives who

visit may be boring. However, the sentence 'Visiting relatives can be generous' does not offer the same duality of interpretation. It is grammatical to say 'Visiting relatives are generous,' but the counterpart 'Visiting relatives is generous' is ungrammatical. Similarly, 'Moving houses is easy' is acceptable, whereas 'Moving houses are easy' is not. And, consequently, 'Moving houses can be easy' is not ambiguous.

Two of the three remaining ambiguous sentences were composed of, among other constituents, the verb stop followed by a gerund. The ambiguity arises because there are two interpretations of the subject of the gerund. These different interpretations occur because in the deep structure there are different subjects for the verbs which eventually become gerunds. Consider the sentence 'The police stopped fighting on campus.' This sentence may mean either that the police quit fighting on campus, in which the police is the subject of fighting, i.e., the police were doing the fighting, or that the police ended fighting on campus, in which the subject of fighting is some unspecified but implied agent other than the police.

The final sentence type on the test is also one in which a nominal construction may be interpreted in more than one way. The test sentence is 'The shooting of the Indian was bad.' This nominal + of + NP construction is often ambiguous because the NP may be both the agent of the action expressed in the nominal or it may be the object of that action. In the case of this sentence, the Indian may be either the shooter or the victim.

For each sentence there was a set of four pictures for the subjects to choose from. An example of each set of pictures appears in Appendix C. For the pretest sentences, in two cases only one of the four choices was correct, and in three cases there were two pictures which were not identical but which were appropriate choices for the pretest sentence. For example, for the pretest sentence 'They are riding horses,' there were two pictures of people riding horses, but the pictures differed in their details. There were also two pictures which were not appropriate to the sentence. The purpose of having two different pictures which corresponded to the same sentence was to determine that the subject could perform the task of pointing to two pictures if they both matched the sentence.

For the test sentences there were also four pictures for each sentence. For each ambiguous sentence and its two unambiguous counterparts, the same four pictures were used. However, the location of the pictures within each set was randomized to avoid a positional bias. The four pictures consisted of one picture for each meaning of the ambiguous sentence and two pictures of related but different and inappropriate events.

All of the pictures were made into two-inch slides and were projected onto a solid-colored wall with a Kodak Carousel 750 Slide Projector. The pictures were labeled A, B, C, or D.

The score sheet for each subject provided space for recording the name, age, sex, and teacher, as well as the subject's

responses to both the pretest and test sentences. Sufficient space was allotted for any notable comments which the subjects may have made or for any remarks which the experimenter may have felt necessary.

Procedure

Subjects were tested individually in a quiet room which was dark enough to allow adequate viewing of the slides. The subject was seated in a chair approximately six feet from the wall on which the slides were projected. The projector was behind and to the left of the subject. The experimenter sat to the right of the subject and controlled the projector with a push-button, remote-control device.

The experimenter explained to each subject that she wanted him to tell her which picture or pictures matched the sentences which she was going to read to him. The experimenter repeated or rephrased the instructions when necessary. On some occasions if the subject said he did not understand, the experimenter said, 'Let's try one and see if you understand then.' As soon as the first slide appeared and the subject heard the first sentence, the experimenter asked, 'Now, which picture or pictures go with that sentence?' Almost always, if there had been any question in the subject's mind, he would answer, 'Oh! Now I get it,' or something comparable.

The subject indicated which picture or pictures he felt were appropriate by naming the letter A, B, C, or D which labelled the pictures. At no time did the task of choosing

letters to indicate which picture or pictures the subject felt appropriate seem too difficult.

The experimenter recorded the subjects' responses on the score sheets, taking care to record the sequence if more than one response were given. The experimenter also recorded any of the subjects' comments which the experimenter felt were valuable to this study. Some of these comments offered insights into the subjects' thoughts as they participated in this experiment. For example, in the sentence 'He wants to prevent smoking,' several subjects asked, 'What does prevent mean? Start or Stop?' For the sentence 'Moving houses can be frightening,' there were comments such as 'What kind of moving?' and 'When you're moving them or when they are moving by themselves?' Another subject, when he heard the sentence 'Shooting stars is exciting,' commented, 'That just doesn't seem right. Is exciting? Oh! D.' One subject who had no problem comprehending the ambiguities found them very funny. 'A dog walking . . . This is funny, get it?' 'That is funny. Grownups are playing.' These and other comments provided a valuable view of what the subjects were doing and thinking and how they performed the tasks of this experiment.

The conditions of this experiment were informal. If a subject did not clearly understand a sentence which was read to him, the experimenter repeated the sentence. The task of this experiment was based on the subject's ability to comprehend the structure of a sentence. It was not a test of his ability to perceive the sentence itself. Because intonation

does not affect the reading of the sentence, repetition did not alter any of the conditions of the experiment. Also, if the subject had any questions and if the answers to those questions would not alter the conditions of the experiment, the experimenter answered the subject's questions. For example, when one subject asked, 'What does prevent mean? Start or Stop?' the experimenter answered, 'Stop.' However, when a subject asked, 'What kind of moving?' in reference to the sentence 'Moving houses can be frightening,' the experimenter answered, 'Whatever it means to you.' An answer to the last question on the part of the experimenter would have invalidated the test question. There would have been no way to explain what kind of moving without providing too much information to the subject.

After each subject had responded to the test sentences, the experimenter asked him to look at some of the pictures which he had just seen and to indicate what the pictures represented to him. This was done because there was some question as to the interpretation of some of the pictures. To make sure that the pictures represented to the subjects what they represented to the experimenter, the experimenter showed some of the slides again and asked, 'What is going on in picture A [or any other picture]?' The experimenter did this for usually five or six pictures per subject. Ultimately, there seemed to be no problem with the subjects' interpretations. The subjects generally interpreted them correctly. They often verbalized their interpretations with the same words that they

had heard in the testing. During the test they may not have chosen the picture of two adults playing Pin the Tail on the Donkey (Appendix C, p. 97) for the sentence 'Playing grownups can be funny.' But when they described that picture they usually said, 'Two grownups playing Pin the Tail on the Donkey.' Usually, in their descriptions of the subject nominals, the ing form followed the noun: 'Two dogs walking,' 'A boy shooting at the stars,' 'Two houses moving,' or 'A horse painting a flower.'

The entire testing procedure took just less than ten minutes per subject.

Results

The results of this experiment were quite different from those which were anticipated. The expected pattern was for the subjects to choose two pictures each for the first ten sentences, indicating their comprehension of the ambiguities of these sentences and to choose one picture for each of the last twenty sentences, indicating their comprehension of these sentences which were not ambiguous.

On the first ten sentences, those which were ambiguous, there was no significant difference at the .05 level in perception of ambiguity regardless of age as determined by the Mann-Whitney U Test (Bruning and Kintz 1977:224). See Table 1. This perception of ambiguity was measured as the number of times the subjects chose more than one picture to match the ambiguous sentences. If a subject chose more than two pictures

for a sentence, and sometimes this happened, this still counted as one instance of perception of ambiguity. This absence of a significant difference means that the eight-year olds perceived ambiguity as often as eleven-year olds did. This particular finding differs considerably from the results which Frank Kessel obtained.

Even more surprising were the results on the unambiguous sentences. The subjects continued to choose more than one picture per sentence even for the unambiguous sentences. This pattern of response was the same for all four age groups as determined by the Mann-Whitney U Test at the .05 level of significance. See Table 2. In other words, performance did not improve with age. Regardless of age the subjects consistently chose more than one picture for the unambiguous sentences.

Frequently, the subjects chose more than one picture for the unambiguous sentences more often than they did for the ambiguous sentences. It appeared that the more they heard the nominals, the more meaning they perceived for them, regardless of the fact that the second and third times the subjects heard the nominals, the nominals occurred in unambiguous sentences. For example, if a subject heard 'Playing grownups can be funny' and chose only one picture, indicating he perceived only one meaning for the sentence, he frequently chose more than one picture later on in the test when he heard 'Playing grownups is funny' and 'Playing grownups are funny.' Quite obviously, subjects who chose more than one picture for the

TABLE 1

Mean Number of Choices of Two Pictures
for the Ambiguous Sentences

Age	Mean	Number of Sentences
8	3.36	11
9	3.90	10
10	4.63	11
11	5.40	15

TABLE 2

Mean Number of Choices of Two Pictures
for the Unambiguous Sentences

Age	Mean	Number of Sentences
8	5.45	11
9	6.60	10
10	8.09	11
11	8.46	15

unambiguous sentences were responding to the ambiguity of the nominals and not to the verb form is or are which should have disambiguated the sentences.

Another indication that the subjects' responses were determined solely by the meaning of the nominal, and not the nominal in the context of the entire sentence, was the fact that some subjects saw one meaning for an ambiguous sentence and they continued to see that same meaning for both of the unambiguous sentences. For these subjects, too, the verb form is or are had no effect on their choice of picture.

Often during the testing procedure the subject would repeat the sentence or part of it to himself. On those occasions when the subject repeated just the nominal in an unambiguous sentence and then selected two pictures, the experimenter cautioned the subject to listen to the entire sentence and then the experimenter repeated the sentence. This, however, never had any effect. The subjects consistently chose the same pictures again.

Sometimes the subjects heard an unambiguous sentence but repeated the ambiguous version of it. The experimenter responded with 'No; listen carefully. Playing grownups is funny.' Although stressing the verb form violated the conditions of the experiment because it should have affected the subjects' responses, there was no effect whatsoever. No amount of prompting changed the subjects' choices of pictures.

After the test was completed, the experimenter informally asked those subjects who chose more than one picture for some

of the unambiguous sentences if they could distinguish between two sentences from the test whose meaning depended on the verb form is or are: 'Can you tell me the difference between "Shooting stars is exciting" and "Shooting stars are exciting?"' All of the subjects, some more consistently than others, were able to make the distinction. They were not always correct in their explanations, and they often had problems verbalizing the difference, but it was definite that when the subjects heard both sentences together, they were able to distinguish between them.

Two of the subjects, a nine-year-old girl and a ten-year-old boy demonstrated a thorough understanding of the principles involved in both the ambiguous and the unambiguous sentences. Neither selected all of the pictures correctly, but they both improved as they progressed through the test. The female subject chose two pictures for the ambiguous sentences eight out of ten times and for the unambiguous sentences only six out of twenty times. The six choices of more than one picture for the unambiguous sentences occurred early in that part of the test. After the first seven unambiguous sentences, she chose two pictures only once. When the experimenter asked her, after the formal testing was completed, why she chose only one picture for some of the unambiguous sentences, the subject attempted to explain. She became quite confused in her explanation, lacking the ability to articulate the procedure she was using. However, she clearly understood the difference. Her best attempt at an explanation was 'You just don't say it that way.'

The male subject articulated more of his thoughts as he participated in the test. For the ambiguous sentences he chose two pictures seven times. For the unambiguous sentences, he chose two pictures only four times. When he heard the unambiguous sentences, he often repeated them slowly and thought carefully about his answers. His comments indicated his comprehension of the sentences and the tasks involved: 'Shooting stars are exciting?' He then chose the correct picture. For the sentence 'Shooting stars is exciting,' he commented, 'That just doesn't seem right. Is exciting? Oh! D.' And for 'Moving houses are frightening,' he responded, 'Now I get it --houses that are moving.' This subject's indecision seemed to imply that he had only recently acquired or was still in the process of acquiring the ability to handle these sentences.

Although neither of these two subjects was correct on all of the test items, each clearly demonstrated an ability to distinguish during the test between the ambiguous and unambiguous sentences. It was not necessary for these subjects to hear both unambiguous sentences of a set together in order for them to distinguish between the sentences. These subjects seemed well on their way to acquiring the linguistic structures and cognitive capacities necessary for the tasks of this experiment. They were the only two subjects to display this behavior.

Because the results of this experiment were so different from those which were hypothesized, the experimenter decided to alter the test conditions somewhat in order to determine

the reasons for the unexpected results. Each of the changes in the test design is considered as a separate experiment, and each is discussed separately in the following sections.

Experiment II

Since the ambiguous sentences preceded the unambiguous sentences in Experiment I, the ambiguous sentences may have been causing the subjects to see more than one meaning for the unambiguous sentences. For this reason, the order of presentation of the test sentences was altered so that the unambiguous sentences preceded the ambiguous sentences.

Method

Subjects. Six subjects, three male and three female, from P.K. Yonge Laboratory School in Gainesville, Florida, participated in this experiment. There were three groups consisting of one male and one female. The groups were separated by age into 8, 9, and 10 years old. All subjects were white, native speakers of English.

Apparatus. The apparatus for this experiment were the same as those used in Experiment I. The only change in the apparatus was that the twenty unambiguous sentences were presented before the ten ambiguous sentences. This was done because it was felt that the subjects may have seen ambiguity in the unambiguous sentences because they had already been exposed to the ambiguous sentences.

Procedure

The procedure was identical to that of Experiment I.

Results

Changing the order of the sentences so that the unambiguous sentences preceded the ambiguous sentences did not alter the subjects' interpretations of the unambiguous sentences. Five of the six subjects saw ambiguity in eight to eleven of the unambiguous sentences. The sixth subject saw no ambiguity in any of the sentences. Apparently, the order of presentation, whether that which was used in Experiment I or that used in Experiment II, was not relevant to the subjects' perception of ambiguity.

Discussion

With the exception of the student who saw no ambiguity in any of the thirty test sentences, there was no difference by age or sex in the perception of ambiguity in both the ambiguous and the unambiguous sentences. The results of this experiment suggest that the order of presentation of these sentences does not affect performance. That the subjects perceived ambiguity in sentences that were theoretically unambiguous still remained to be explained.

Experiment III

The first two experiments demonstrated four points:

1. Subjects perceived ambiguity in both the ambiguous and the unambiguous sentences.

2. The order of presentation of test sentences may be either ambiguous followed by unambiguous sentences or unambiguous followed by ambiguous sentences without any effects in the subjects' perception of ambiguity.

3. The verb forms is and are which should have disambiguated the nominals did not.

4. Although the subjects perceived many of the unambiguous sentences as ambiguous, they were able to distinguish between the two sentences of the pair of unambiguous sentences when those two sentences were presented together for them to compare. To restate this point, if the experimenter asked a subject to explain the difference between two sentences which differed on the surface only in the verb is or are such as sentences 2.d. and 2.e., the subjects were almost always capable of making the necessary distinction. They did not, however, use this information during the test situation. Instead, when they heard either 2.d. or 2.e., they indicated that the sentence was ambiguous by choosing more than one picture to match the sentence.

2.d. Moving houses is frightening.

2.e. Moving houses are frightening.

Because of these facts, it was felt that if the subjects were exposed to sentences of the same type as those on the test before the actual test began, and if they were given practice in making distinctions between these sentences, this pretest experience might encourage the students to employ this distinction during the test.

Method

Subjects. Five students from P.K. Yonge Laboratory School in Gainesville, Florida, participated in this experiment. Of the five, four were ten years old and one was nine. Four of the subjects, including the nine-year-old, were female, and one was male. All of the subjects were white, native speakers of English.

Apparatus. The apparatus for this experiment were identical to those in Experiment I with one exception. Four new, theoretically unambiguous sentences were added as additional pretest items:

- 2.f. Bouncing balls is fun.
- 2.g. Bouncing balls are fun.
- 2.h. Flying kites is fun.
- 2.i. Flying kites are fun.

Procedure

The procedure in this experiment was almost identical to that of Experiment I. The only difference was that, after the five original pretest sentences, the experimenter presented four more pretest sentences to the subjects. The experimenter asked each subject to listen carefully to the two sentences which she was about to repeat. The experimenter then asked, 'Can you tell me the difference between these two sentences: "Bouncing balls is fun" and "Bouncing balls are fun"?' The experimenter recorded each subject's responses and then asked, 'Can you tell me the difference between these

two sentences: "Flying kites is fun" and "Flying kites are fun"?' The experimenter again recorded the subject's responses and then began the actual test. The rest of the test continued in the same manner as in Experiment I.

Results

In general, exposure to the sentence patterns and experience in distinguishing between pairs of sentences did not facilitate performance on the test.

Four of the five subjects chose more than one picture for some of the unambiguous sentences. One chose two pictures for eight of the twenty unambiguous sentences, one chose two for nine of the twenty, one for ten of the twenty, and one for eleven of the twenty.

Only one subject, a ten-year-old female, chose only one picture for each of the unambiguous sentences. She chose two pictures for five of the ten ambiguous sentences. It would appear that she understood the task of the experiment fairly well, except for the fact that, of the twenty unambiguous sentences, she chose seven incorrect pictures.

Of the four who continued to see ambiguity in the unambiguous sentences, three demonstrated an ability to distinguish between the two sentences in each pair that was presented in the pretest. That ability did not, however, appear during the test situation, since they still chose more than one picture several times. One subject could not explain a semantic difference between the two sentences in each pair of unambiguous

sentences in the pretest. For him, the sentences with the verb is had the same meaning as the sentences with are, except that he felt those with is were ungrammatical. This feeling did not stop him during the test from choosing two pictures for nine of the twenty unambiguous sentences.

Discussion

This test design did not help the subjects to see the difference in the sentences with is and the sentences with are.

Experiment IV

Because none of the previous test designs consistently elicited a distinction between the members of the pairs of unambiguous sentences, a new design was developed. The problem of the verb be was eliminated by changing the structure of the sentences which had previously had can be to I like + nominal ('I like visiting relatives'), those which had is to I like + infinitive ('I like to visit relatives'), and those which had are to I like + noun + that are + verb + ing ('I like relatives that are visiting'). It was hoped that eliminating the verb be would eliminate the subjects' problems in distinguishing between the two types of nominals.

Method

Subjects. Four students from P.K. Yonge Laboratory School in Gainesville, Florida, were chosen to participate in this experiment. There were two ten-year-old males and two eleven-year-old females. All four subjects were white, native speakers of English.

Apparatus. This test design included the five pretest sentences which were used in Experiment I to assure that the subjects could adequately perform the task of selecting more than one picture if more than one picture was appropriate to the sentence which they heard. The test sentences, which appear in Appendix B, consisted of twenty-seven sentences, nine of which were ambiguous and eighteen of which were unambiguous. Of the nine ambiguous sentences, six consisted of I like + nominal, in which the nominal could be either a subject nominal or an object nominal. The other three ambiguous sentences were the same three from the original test design which were not built on the nominal + can be + adjective structure. The unambiguous sentences consisted of the six sentences from the original design which were not dependent on the verb be and of twelve sentences which were interpretations of the I like + nominal sentences. These twelve sentences consisted of six I like + infinitive structures and six I like + noun + that are + verb + ing, as in the following set:

- 2.j. I like playing grownups.
- 2.k. I like to play grownups.
- 2.l. I like grownups that are playing.

As was true of the design for Experiment I, each unambiguous sentence represented one of the meanings contained in the ambiguous sentences. Again, the purpose of this design change was to eliminate the problems that arose with the verb be. The remaining aspects of the apparatus--the slides, projector, and score sheet--were the same as those in Experiment I.

Procedure

This aspect was also similar to that of Experiment I. The only difference was in the sentences that were read.

Results

On the nine ambiguous sentences, two subjects chose two pictures seven times, one subject chose two pictures eight times, and one chose two pictures nine times. On the eighteen unambiguous sentences, one subject chose two pictures five times, one seven times, one nine times, and one ten times.

This design, like the ones that preceded it, failed to elicit a consistent distinction between subject and object nominals. In even the most unlikely cases, for example, 'I like to visit relatives,' two of the subjects chose two pictures.

Discussion

No matter what the method of testing, it seemed that the subjects could not be forced into distinguishing between when the subject-nominal interpretation was appropriate and when the object-nominal interpretation was appropriate. For some reason the subjects appeared to be treating all of the nominals as surface lexical items rather than as derived structures.

Experiment V

Because there were no age differences in either the perception of ambiguity or in performance on the unambiguous sentences, it remained unclear as to when subjects actually

begin to make the distinctions necessary to perform well on the unambiguous sentences. Some of the results of the preceding experiments implied that the ability to interpret the relationships among the trio of sentences made up of an ambiguous sentence and its two unambiguous counterparts, the ability to distinguish between the two unambiguous sentences in the trio, and the ability to recognize that the unambiguous sentences were in fact unambiguous were available only to those people who have an overt interest in language. These abilities certainly did not seem to be a part of these native speakers' intuitions about language.

It was decided that it would be helpful to know how college-aged adults would perform the tasks of Experiment I in this investigation. If they had no problems with the test sentences, then somewhere between the ages of 12 and 18 years, there should be a point which could be labeled 'the normal age of acquisition' of the abilities needed to handle the elements of this test. If adults were not able to make complete distinctions between the unambiguous sentences and were not sure that the unambiguous sentences were unambiguous, then these abilities most probably belong only to those people who consciously analyze their language.

This latter possibility seems remote because it would be quite wasteful for a language to offer distinctions for its speakers if the speakers do not naturally utilize them. These distinctions should not exist for the language-conscious only,

but should be an active part of any native speaker's ability to interpret his language. On the other hand, it is possible that this wasteful aspect is prevalent in language. Many people may never acquire certain transformations.

Method

Subjects. Seven students from the University of Florida were chosen haphazardly to participate in this experiment. These students ranged from 18 to 22 years in age. Three were males and four were females. All were white, native speakers of English.

Apparatus. The apparatus were identical to those in Experiment I.

Procedure

The procedure was identical to that of Experiment I. The only change was in location. Experiment I was conducted at P.K. Yonge Laboratory School. Experiment V was conducted in General Purpose Building A on the main campus of the University of Florida.

Results

On the whole, these adult subjects demonstrated a more thorough comprehension of the elements of this test. The ten ambiguous sentences presented more problems to these subjects than the unambiguous sentences did. No subject chose two pictures for all of the ambiguous sentences. The seven subjects each heard ten ambiguous sentences, for a total of

seventy total exposures to the ambiguous sentences. Out of these seventy exposures, the subjects correctly chose two pictures twenty-nine times or 41 percent of the time.

Performance on the unambiguous sentences was much better. Twenty unambiguous sentences presented to the seven subjects provided one hundred forty exposures to the unambiguous sentences. The subjects chose two pictures only fourteen times out of the possible one hundred forty times, or for 10 percent of the time. This was by far the fewest times that subjects in any one test design chose two pictures for the unambiguous sentences. Even though these subjects chose only one picture for the unambiguous sentences more frequently than the subjects in previous test situations, they chose the wrong picture twenty-nine times or 21 percent of the time.

Discussion

In order for subjects at a particular stage in development to have mastered a specific aspect of their language, they should demonstrate an ability to use that part of their language consistently. In other words, subjects should reach an age at which it becomes useless to test them because at that age they show no difficulty with the test items. This does not mean that all the subjects in that age group must get 100 percent of the items correct. There are numerous reasons why some errors may show up. But there should be a consistent demonstration of proficiency with the test items.

The subjects in this test have not demonstrated such a proficiency. Perceiving only 41 percent of the ambiguities

and seeing ambiguity in unambiguous sentences 10 percent of the time with twenty-nine errors in the choice of pictures for the unambiguous sentences would not seem to be a demonstration of proficiency with these test items. It is true that these subjects chose two pictures only 10 percent of the time, whereas the subjects in the previous experiments chose two pictures from 28 percent to 39 percent of the time.

The subjects' performances during the test and their comments after the test often indicated different things. For example, one subject chose two pictures for only three ambiguous sentences and chose only one picture for each of the unambiguous sentences. Although the test demonstrated that this subject understood the unambiguous sentences, it did not indicate that he perceived the ambiguity in the first ten sentences. His comments after the test, however, showed that he understood not only the ambiguities ('with can be, it can have two meanings') but also the design of the test ('changing from can be to is and are'). Although this ability to describe the test design seems quite simple, very few of the subjects, regardless of age, were able to explain what was happening during the test.

Another subject's performance during the test differed from his comments after the test. This subject chose two pictures for seven of the ten ambiguous sentences and for five of the twenty unambiguous sentences. Yet he commented that all of the sentences with is were ungrammatical.

Like the younger subjects, the adults were able to distinguish between sentences with is and those with are if the two sentences were presented together for them to compare. They, too, did not always employ this distinction when they chose pictures.

Discussion of Experiments I Through V

An experiment was designed to determine the age at which children develop the ability to perceive deep-structure ambiguity as in the sentence 'Flying kites can be exciting.' It was hypothesized that the ability to perceive both meanings in this sentence would develop only after the child could comprehend both of the unambiguous sentences which represent the meanings which are contained in this ambiguous sentence. These two sentences are 'Flying kites is exciting' and 'Flying kites are exciting.' The results of this experiment were completely different from those which were anticipated.

There was no significant age difference in ability to perceive the ambiguity of the ambiguous sentences. What the subjects failed to comprehend was the fact that the unambiguous sentences were unambiguous. These subjects repeatedly saw more than one meaning for the unambiguous sentences.

In order to determine whether the subjects' behaviors were the result of some feature of the design or if, in fact, the subjects could not comprehend that these sentences were not ambiguous and if not, why, four more designs were used. The results from these four experiments indicated that with the

exception of the adults and regardless of test design the subjects were unable to tell that the unambiguous sentences were unambiguous, unless the pair of unambiguous sentences was presented together for the subjects to compare. Only then could the subjects explain the difference between the two sentences and recognize that these sentences were not ambiguous.

This inability on the part of these subjects to analyze the unambiguous sentences unless they were presented in pairs suggests that the ability to perform such an analysis is available only to those people who consciously analyze their language.

Although it may seem strange that a language may offer distinctions which its speakers do not naturally use, this happens quite often in terms of vocabulary items which people may never learn or use and transformations which some people may never acquire. That many people may never be able to distinguish between the unambiguous sentences would not hinder their ability to communicate since most ambiguities become disambiguated in the contexts in which they are used.

The results of these five experiments raised a large number of questions. The most obvious question was 'why did the subjects perform so differently from the way that the theory had led me to predict?' This question, of course, embodied many other questions.

Since the only difference in the surface structure in the pairs of unambiguous sentences such as 'Flying kites is exciting' and 'Flying kites are exciting' lies in the verbs is

and are, it appeared that these verbs were not meaningful to the subjects in their interpretations of the sentences. There was no question that the subjects heard the verbs, since the experimenter violated the conditions of the original experiment to make sure that they heard these verbs. What was unclear was whether it was the verb be or the presence or absence of the plural marker on the verb which was causing problems for the subjects. It seemed quite possible that it was the verb be because this verb carries no meaning.

In order to determine which of these factors was operating, a completely new test design was developed. This design tested both the verb be and the plural marker in the contexts of twelve ambiguous sentences and twelve unambiguous sentences.

CHAPTER III

EXPERIMENT VI

The subjects who participated in the first five experiments demonstrated an inability to properly analyze sentences whose structures were of the form nominal + be + adjective, when the nominal was structurally ambiguous. The sentences which the subjects heard were either ambiguous because the verb form did not determine which meaning of the nominal should be available or unambiguous because the verb form did determine which meaning of the nominal should be available. Sentence 3.a. is an example of the ambiguous sentence type, and sentences 3.b. and 3.c. are examples in which the verb form should disambiguate the nominal.

3.a. Moving houses can be dangerous.

3.b. Moving houses is dangerous.

3.c. Moving houses are dangerous.

From a descriptive standpoint, the singular form of a verb determines that the nominal be interpreted as an object nominal; that is, in sentence 3.b., houses is the object of moving. The plural form of the verb determines that the nominal be interpreted as a subject nominal; for example, in sentence 3.c., houses is the subject of the sentence and moving functions as an adjective modifying houses. The verb

in sentence 3.a., can be, has no inflection for number and, consequently, provides no information to disambiguate the nominal.

Apparently, not all native speakers, even some adults, make these distinctions between 3.b. and 3.c. unless they have both sentences available at the same time. Most of the subjects in the previous experiments viewed sentences of the form of 3.b. and 3.c. as ambiguous. It appears that the syntactic information contained in the verb was not enough to override the ambiguity of the nominal. It was not clear whether the problem resided in the verb be which has no meaning or in the presence or absence of the plural marker.

In order to determine what factors were operating for the subjects, a new experiment was designed. Twenty-four sentences based on the nominal + verb + adjective structure made up the test. In this design both the verb be and the verb look were tested in both singular and plural forms. This was done to determine if subjects would have the same problems if the main verb in the sentence were not some form of be.

Another variable in this design was the type of nominal. Twelve of the nominals were ambiguous and twelve were not. All of the nominals contained a plural noun. The subjects were asked to select the correct verb form; that is, they were to circle is or are in twelve sentences and looks or look in twelve sentences. For the ambiguous nominals either form of the verb would be correct. (See sentences 3.d. and 3.e.)

However, for the unambiguous nominals there was only one correct verb form for each sentence. (See sentences 3.f. through 3.i.)

3.d. Sailing boats is/are dangerous.

3.e. Sailing boats looks/look dangerous.

3.f. Making cookies is/are fun.

3.g. Making cookies looks/look fun.

3.h. Roaring lions is/are scary.

3.i. Roaring lions looks/look scary.

The nominals in sentences 3.f. and 3.g. are object nominals, and the only grammatical verb form in each sentence is the singular form. The nominals in sentences 3.h. and 3.i., however, are subject nominals and are grammatical with only the plural form of the verb.

Because the subjects in the previous experiments had viewed sentences such as 3.d. as ambiguous, it was suspected that the subjects in this experiment might do the same. It was also expected that some subjects might choose the plural verb form for all of the nominals because the nominal phrases end in s and the plural noun is next to the verb. This type of behavior constitutes a strategy which may not always produce the correct result. For example, in sentence 3.f. some speakers may choose are because the noun cookies, which is plural, is next to the verb. Although the word cookies is not the subject of the sentence, it was felt that some speakers might behave as if it were. Such a strategy would generate the ungrammatical sentences 3.j. and 3.k.

*3.j. Making cookies are fun.

*3.k. Making cookies look fun.

This strategy applied to subject nominals also generates the plural verb form, but in this case, it is the correct form. If this strategy is actually being utilized, there should be significantly more errors with object nominals than with subject nominals.

The subjects' behavior on this test should indicate the importance of the verb form in interpreting the nominal. If there were not significantly more errors with object nominals than with subject nominals, it might mean that the verb form was irrelevant to the interpretation of nominals. This would follow if the syntactic information contained in the verb were not enough to override the ambiguity of the nominal.

There were two other questions which this design attempted to answer:

1. Is there a developmental point at which the verb becomes relevant to the interpretation of the nominal?
2. Is this linguistic behavior in any way a function of education?

It seems that the ability to distinguish between 'Flying kites is fun' and 'Flying kites are fun' should not be related to how well a person has learned his English grammar lessons. Since the two sentences represent differences in meaning, they should be different to all native speakers of English, who presumably cut up the semantic spectrum along the same lines. There is some indication, however, that these sentences have

the same meaning for some speakers, and consequently, they do not share the same divisions of the semantic spectrum with those speakers for whom these two sentences have different meanings. It may happen that the only explanation for this linguistic behavior is that, unless the subject is overtly and consciously aware of the rules of his grammar, he does not attend to all the grammatical technicalities of a sentence. These subjects rely, quite probably, on context. Contextual factors ordinarily eliminate the need to analyze a sentence closely enough to determine whether a speaker is talking about the act of flying kites or about kites which are flying.

It was in an attempt to sort out some of these factors that the following experiment was run.

Method

Subjects. One hundred eighty-three subjects participated in this experiment. One hundred thirty of these subjects were students between the ages of seven and twelve years old from P.K. Yonge Laboratory School in Gainesville, Florida. The other fifty-three subjects were students at the University of Florida between the ages of eighteen and twenty-nine. In all there were eighty-nine females and ninety-four males. All subjects were native speakers of English. In this experiment there were no restrictions on race.

Apparatus. The apparatus consisted of one sheet of paper for each subject with places at the top for name, age, and sex and with twenty-four sentences, each containing the singular

and the plural forms of the verb be in the present tense or the verb look in the present tense. All of the sentences had a nominal + verb + adjective format. In twelve of the sentences the nominal was ambiguous; that is, it could be either a subject nominal or an object nominal (for example, 'flying kites'). For these twelve sentences, both the singular and the plural forms of the verb were grammatical. In the other twelve sentences the nominals were not ambiguous; six nominals were subject nominals and six were object nominals. The subject nominals were grammatical with only the plural verb, and the object nominals were grammatical with only the singular verb. Each nominal in the test was paired with the verb be in one sentence and the verb look in another sentence. The order of the sentences on the test was random. A copy of this test is in Appendix D.

Procedure

This test was administered in the classrooms at P.K. Yonge and at the University of Florida by the classroom instructors. Each instructor passed out the test forms and directed the students to read each sentence carefully and to circle the correct form of the verb. No other instructions were given. However, for one group, an adjustment had to be made. The youngest group, the seven-year olds, was incapable of reading the test, so their teacher read it out loud to them. Because intonation pattern does not affect the meaning of these sentences, no problems arose from the sentences being read aloud.

Two forms of this test were administered. In one form the order of the twenty-four sentences was the reverse of the order for the second form. One half of the subjects received form one and the other half received form two.

The data were analyzed using the SAS General Linear Model Procedure computer program for analysis of variance. In the ambiguous sentences subjects could not make an error in their choice of verb form. However, because it was thought that subjects might employ a strategy of selecting the plural form of a verb because the noun which precedes the verb is always plural, it was important to know whether the subjects chose the singular or the plural form of the verb in the ambiguous sentences. Therefore, in order to distinguish the responses for the unambiguous sentences from those for the ambiguous sentences, the verbs were divided into six categories: two singular--is and looks, two plural--are and look, and two categories labelled be and lk for the ambiguous sentences. The subjects' responses were recorded in the following manner: for the unambiguous sentences, a correct response was coded as 0, and an incorrect response was coded as 1. Because there was no way to make an incorrect choice of verb in the ambiguous sentences, selection of the singular verb form was coded as 0 and of the plural verb form was coded as 1.

The data were also analyzed from the perspective of the nominals. There were three categories of nominals. For the unambiguous sentences the categories were either Subject or Object nominals. For the ambiguous sentences, the nominal

could be interpreted as either subject or object, and, therefore, the category for the nominals in the ambiguous sentences was labelled Subj-Obj. The numbers in the first two categories were the number of times the subjects chose the wrong verb form for a particular nominal type. The numbers in the category Subj-Obj were the number of times subjects chose a plural verb form for the ambiguous sentences. The responses for nominals also represent a collapsing of the verbs which were appropriate for the particular nominal type. For example, the mean for nine-year-old males with respect to subject nominals represents a collapsing of the scores for nine-year-old males on the verbs are and look because these two verb forms are the correct responses for subject nominals.

One final point, all of the subjects older than twelve were combined into one group. The subjects actually were between the ages of eighteen and twenty-nine, but they were all considered in one age group which was labelled 21-year olds.

Results

Verbs in unambiguous sentences. For those sentences which were not ambiguous, there was a three-way interaction of sex, age, and verb which was significant at the .01 level. The two-way interaction of sex and verb was not significant at the .01 level. The age by verb interaction and the sex by age interactions were significant, the former at an alpha level of .0001 and the latter at an alpha level of .0027. Although the main effect of sex was not significant, the main effects of age and of verb were significant at the .0001 level.

Figures 1 through 4 indicate the percent of incorrect responses for male and female subjects at each age interval for the four verb forms. Figure 1 indicates the number of times subjects chose the verb are when the correct response was is. Figure 2 indicates the number of incorrect responses for are, Figure 3 for looks, and Figure 4 for look. If the four figures are imposed on one graph, the three-way interaction becomes evident. These scores are also listed in Table 3.

Is. When the correct response was is, the seven-year-old male and female subjects' performances of 47 and 42 percent respectively were not significantly different. The eight-year-old subjects were not significantly different either from each other or from the seven-year olds. The nine-year-old males continued to perform in the same manner as the seven- and eight-year olds. The nine-year-old females, however, improved significantly, choosing the verb form are only 28 percent of the time when they should have chosen is. At the age of ten, female subjects performed just as the nine-year-old females. The males, however, did worse at this age than at any other age, choosing are 60 percent of the time when they should have chosen is. The responses of the eleven-year olds were almost the reverse of those for the ten-year olds. The male subjects' scores improved to 24 percent, while the females' scores worsened by 28 percentage points to 57 percent. For the twelve-year olds, there was another reversal. The males' scores rose to 43 percent incorrect, while the females improved by 40 percent to 17 percent incorrect. Finally, the scores

for male and female adults were nearly identical at 11 percent and 12 percent, respectively.

Are. The subjects' behavior when the correct response was are remained more consistent. At the ages of 7, 9, 10, and 11, females did slightly, but not significantly, better than males. At the ages of 8 and 21, males did slightly better. And at the age of 12, both males and females had an identical score of 0 percent incorrect responses.

Looks. At the age of 7, male subjects chose the verb form look 13 percent of the times when they should have chosen looks, whereas the females did this 18 percent of the time. At the age of 8, both males and females did worse than the 7 year olds. The females made errors 26 percent of the time, while the males were incorrect 44 percent of the time. At the age of 9, the males improved to 33 percent and the females improved to 4 percent. At the age of 10, both males and females made errors 17 percent of the time. At 11, males improved slightly to 12 percent and females remained almost the same at 18 percent. At 12, the males had slightly more errors--14 percent, and females made slightly fewer errors--8 percent. The adult males again improved slightly, this time to 9 percent, and the females made errors 15 percent of the time. From the age of ten to adult, none of the scores was significantly different. Although the scores for male and female subjects alternated in terms of which sex had fewer errors at each of these ages, the fact that there was no

TABLE 3

Percent of Incorrect Responses on the Four Verb Forms
by Male and Female Subjects

Age	Sex	Is	Are	Looks	Look
7	M	47	13	13	53
7	F	42	6	18	30
8	M	49	10	44	33
8	F	46	13	26	49
9	M	45	9	33	55
9	F	28	5	4	48
10	M	60	17	17	33
10	F	29	13	17	28
11	M	24	15	12	18
11	F	57	9	18	27
12	M	43	0	14	0
12	F	17	0	8	25
21	M	11	1	9	4
21	F	12	1	15	3

Note. All scores are rounded off to the nearest percentage point.

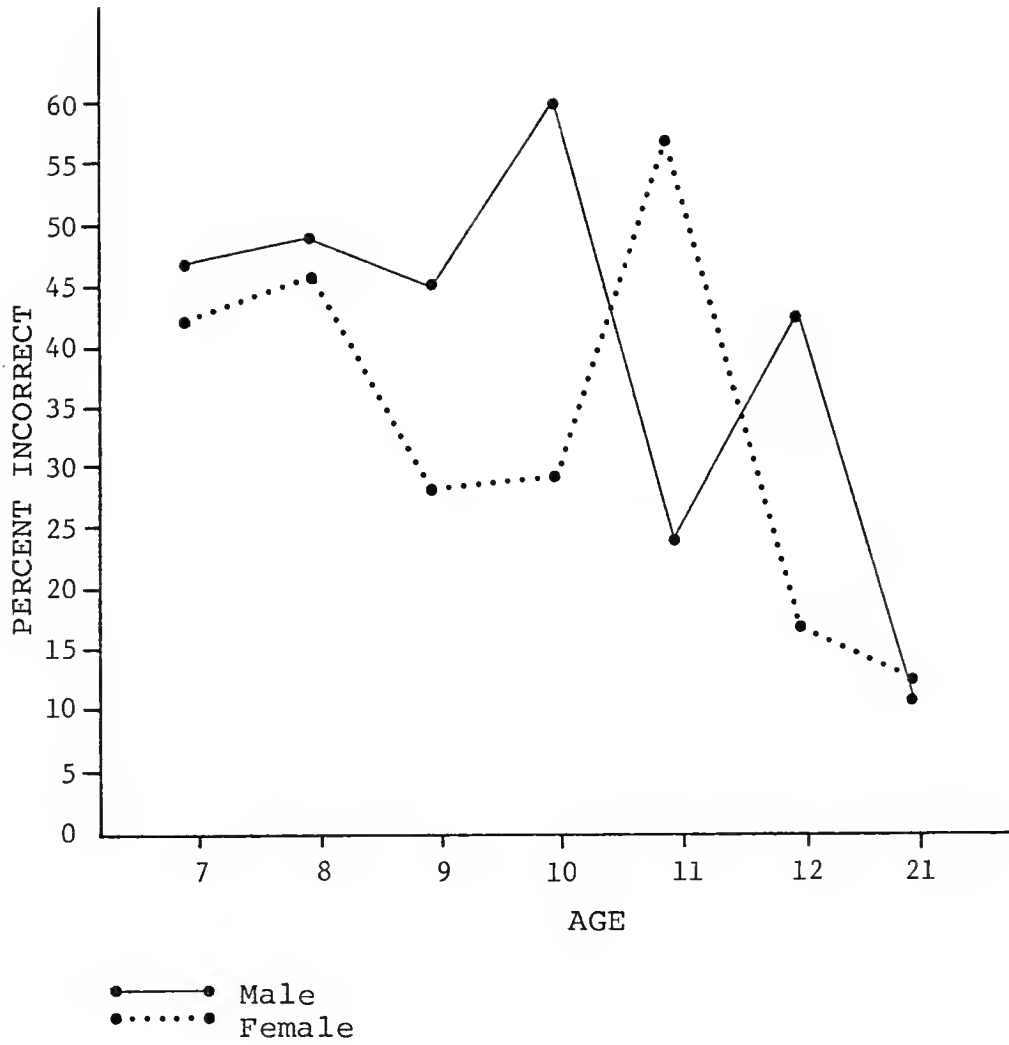


Figure 1. Percent of incorrect responses for the verb form Is by male and female subjects.

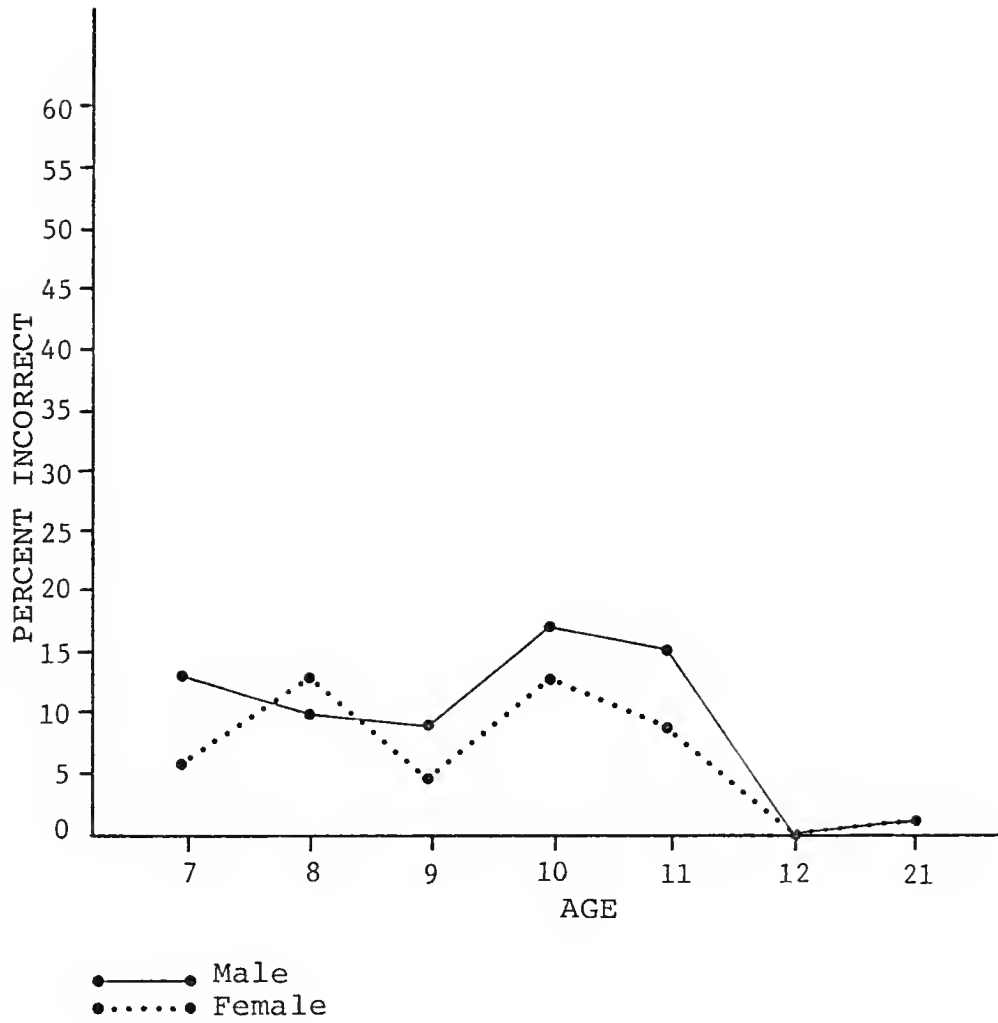


Figure 2. Percent of incorrect responses for the verb form Are by male and female subjects.

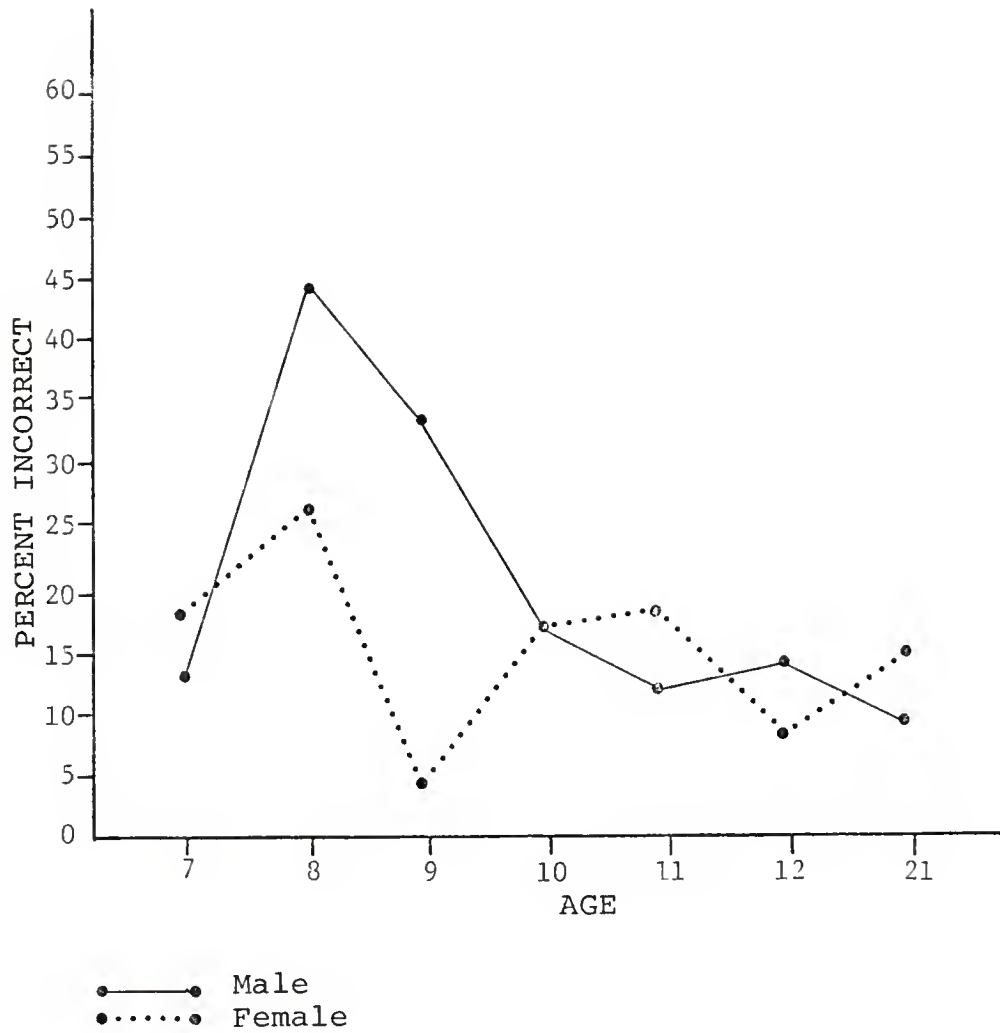


Figure 3. Percent of incorrect responses for the verb form Looks by male and female subjects.

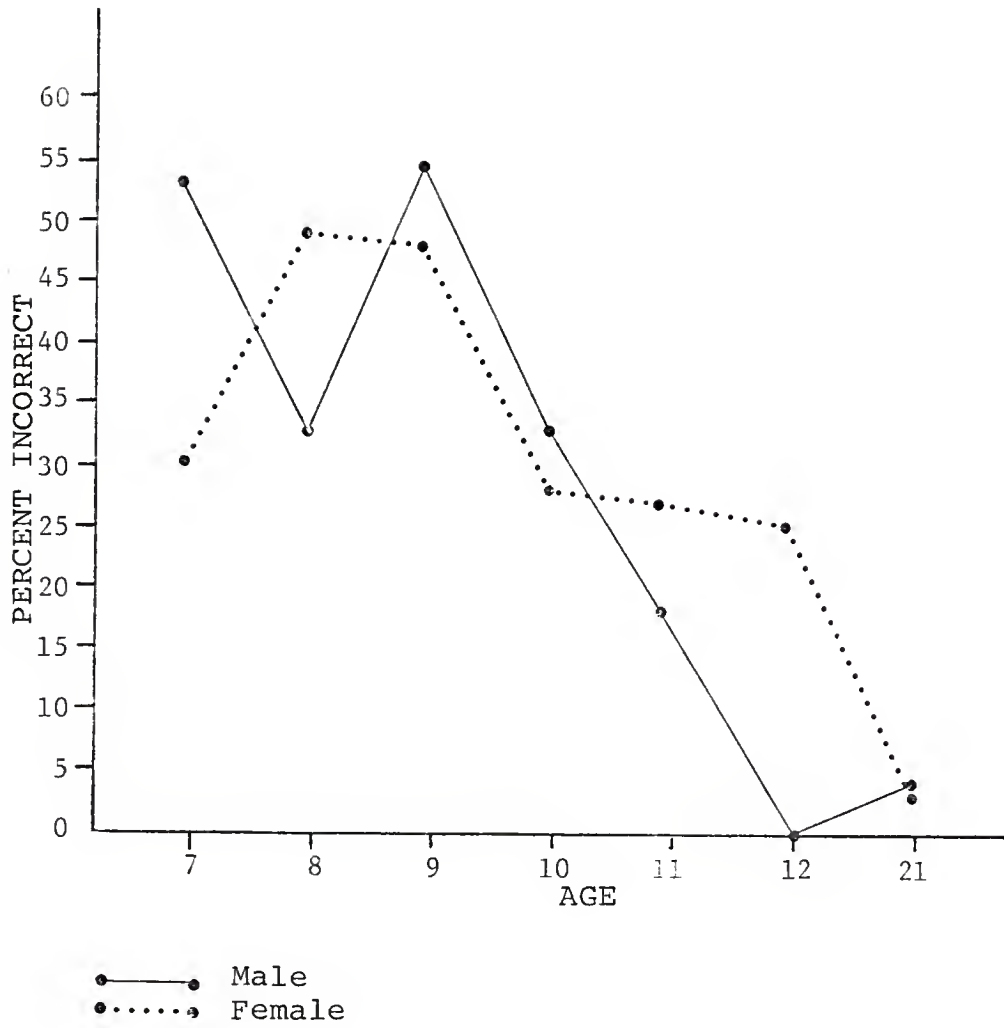


Figure 4. Percent of incorrect responses for the verb form Look by male and female subjects.

significant difference in these scores indicates that there was no genuine improvement after the age of 10.

Look. At the age of 7, male subjects chose looks 53 percent of the times that they should have chosen look. Female subjects chose looks incorrectly 30 percent of the time. At eight, male subjects chose looks incorrectly 33 percent, while females made errors 49 percent of the time. Nine-year-old male and female subjects made errors 55 and 48 percent of the time, respectively. Both male and female subjects improved significantly by the age of ten to 33 and 28 percent, respectively. At 11, males improved to 18 percent while females stayed at 27 percent. At 12, the males again improved; this time they made no errors. The females improved slightly to 25 percent. As adults, the male subjects made errors only 4 percent of the time and females improved to 3 percent.

Nominals in unambiguous sentences. This category is simply a different perspective on the same data. The scores are the combined scores for both the verbs which were grammatical for a particular nominal type. For example, in the sentence 'Growling lions is/are--looks/look scary,' both are and look are grammatical because this sentence contains a subject nominal. These scores, then, indicate the number of errors in choice of verb that males and females at each age interval made for a particular type of nominal. The purpose of looking at these data in this manner is to determine which type of nominal presented more difficulty to the subjects.

The result of this analysis was that there was a significant three-way interaction of sex, age, and nominal at the .01 level of significance. The two-way interactions of sex by nominal and of age by nominal were not significant at the .01 level. The sex by age interaction was significant at the level of .0047. The main effect of sex was not significant, but the main effects of age and of nominal were significant at the level of .0001. These scores are listed in Table 4 and the interaction is evident in Figure 5.

At the age of 7, male and female subjects made errors with object nominals 30 percent of the time. For the subject nominals, males made errors 33 percent and females 18 percent of the time. At eight, male subjects improved on subject nominals to 22 percent but had 46 percent incorrect with object nominals. Females made more errors on both subject and object nominals, 31 percent and 40 percent, respectively.

At nine, males improved with object nominals to 39 percent but with subject nominals they were incorrect 32 percent of the time. The females improved on subject nominals to 26 percent incorrect and on object nominals to 17 percent incorrect. At 10, the males stayed the same on object nominals but improved with subject nominals to 25 percent incorrect. Females improved with subject nominals to 20 percent but had 23 percent incorrect on object nominals. At the age of 11, male subjects improved somewhat to 17 percent on subject nominals and improved significantly to 18 percent on object

TABLE 4

Percent of Incorrect Responses on Subject and Object
Nominals by Male and Female Subjects

Age	Sex	Subject Nominal	Object Nominal
7	M	33	30
7	F	18	30
8	M	22	46
8	F	31	40
9	M	32	39
9	F	26	17
10	M	25	39
10	F	20	23
11	M	17	18
11	F	18	38
12	M	0	29
12	F	13	13
21	M	2	10
21	F	2	14

Note. All scores are rounded off to the nearest percentage point.

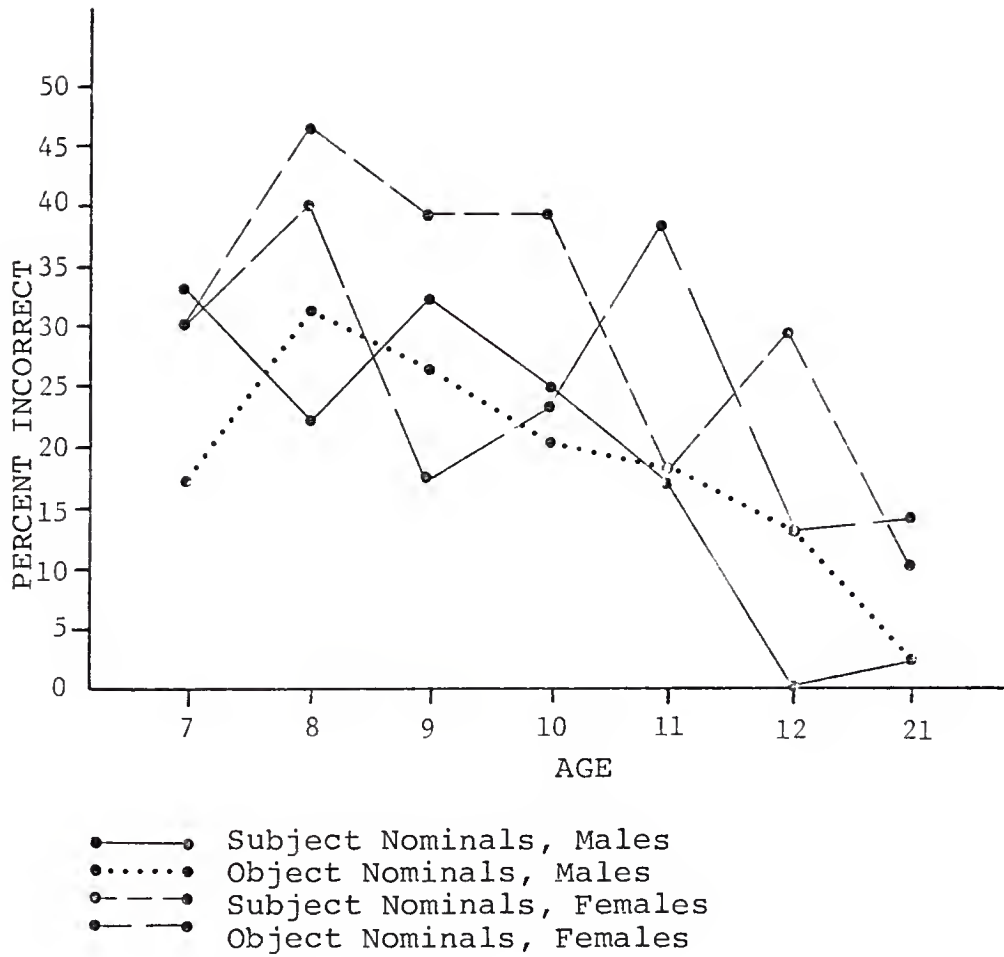


Figure 5. Percent of incorrect responses on subject and object nominals by male and female subjects.

nominals. Female subjects improved just slightly to 18 percent with subject nominals but made significantly more errors, 38 percent, with object nominals.

For the 12-year olds, there was a 29-point divergence between the scores for the male subjects, as they had 29 percent incorrect with object nominals and no errors with subject nominals. The female subjects made errors 13 percent of the time for both subject and object nominals. Adults were more consistent by sex. The males had 10 percent incorrect for the object nominals while females had 14 percent incorrect for the object nominals, and both sexes had 2 percent incorrect for the subject nominals.

Verbs in ambiguous sentences. The scores in this category indicate the percentage of times that the subjects chose a plural verb form in each ambiguous sentence. The results were that the three-way interaction of sex by age by verb and the two-way interaction of sex by verb were not significant at the .01 level of significance. The two-way interactions of verb by age and of sex by age were significant to the level of .0001. The main effect of sex was not significant at the .01 level, whereas the main effects of verb and of age were significant to the .0001 level. Table 5 contains a list of the scores for the verb-by-age interaction. Figure 6 indicates the percentage of plural verb forms that the subjects chose for each main verb at each age interval for those sentences which were ambiguous.

TABLE 5
Percent of Choices of Are and Look
in the Ambiguous Sentences

Age	Are	Look
7	38.0	75.0
8	35.0	62.0
9	54.5	77.0
10	57.0	79.0
11	44.5	77.5
12	71.5	63.5
21	76.5	75.0

Note. All scores are rounded off to the nearest one-half percentage point.

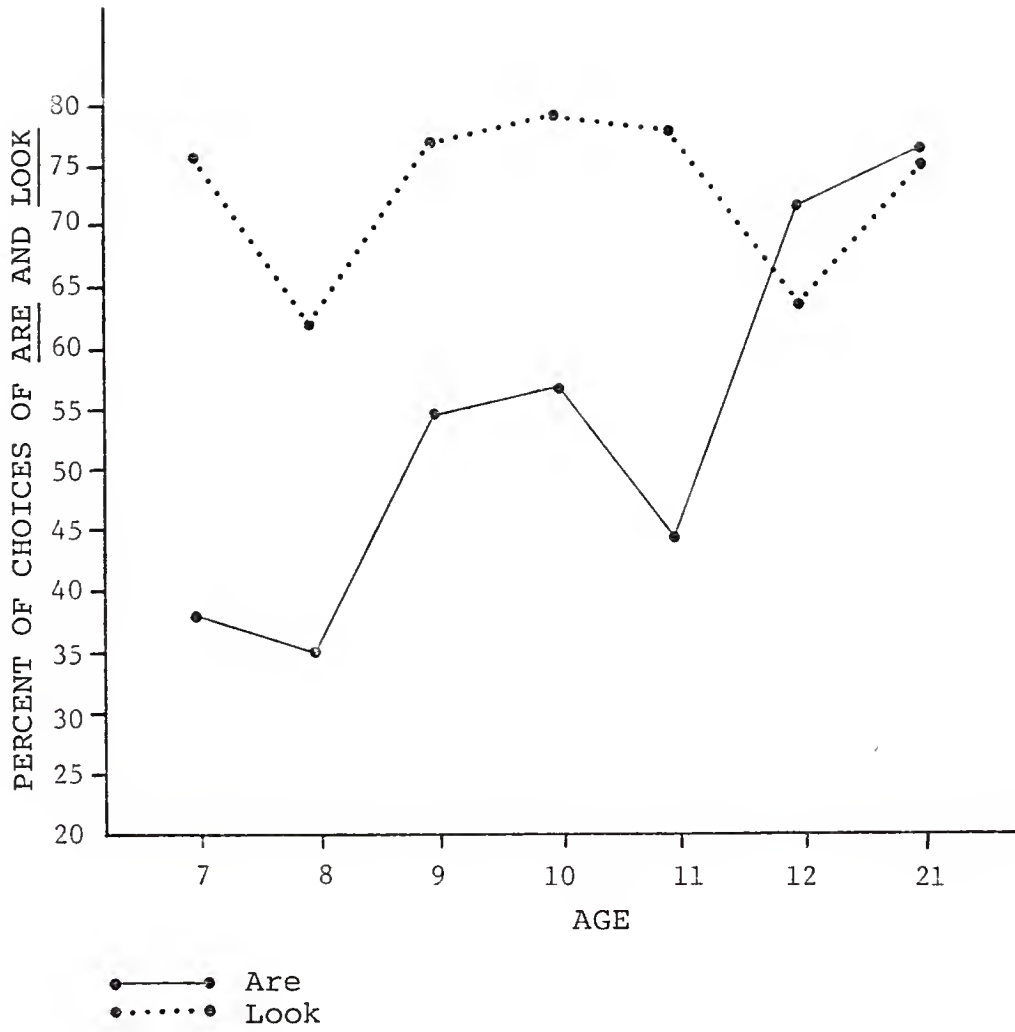


Figure 6. Percent of choices of Are and Look in the ambiguous sentences.

There is a pattern from the age of 7 through the age of 11 for the subjects to choose the plural form at least 23 percent more often for the main verb look than for the main verb be. The differences were significant at the .01 level at the ages of 7, 8, 10, and 11. At the ages of 12 and 21, subjects chose slightly more plural forms for be than for look. The differences for these two ages were not significant. Overall, as the age of the subjects increased, the choices of plural verb forms also increased. The choices of plural verb form for the verb look in the ambiguous sentences were between 62 percent and 79 percent for all ages. However, for the verb be the percentage of plural responses ranged from 35 percent for the eight-year olds to 76.5 percent for the adults.

The scores for the age-by-sex interaction are listed in Table 6, and Figure 7 illustrates this interaction. At the ages of 7, 8, 11, 12, and 21, male subjects chose plural verb forms more often than female subjects did. The females chose more plurals at the ages of 9 and 10. Only the differences at the ages of 10 and 11 were significantly different at the .01 level. From the ages of 7 to 8 there was a decline in plural choices for both sexes. From 10 to 11, there was a decline in the plural choices for females. From 11 to 12, there was a slight decline among the male subjects. In all other instances, the number of choices of plural verb forms increased.

Nominals in ambiguous sentences. Again, to look at the nominals is simply to look at the same data from a different

TABLE 6

Percent of Choices of Plural Verb Forms in the
Ambiguous Sentences by Male and Female Subjects

Age	Male	Female
7	65.0	48.0
8	49.0	47.0
9	59.5	72.5
10	61.0	75.0
11	73.5	48.0
12	68.0	66.5
21	76.0	75.0

Note. All scores are rounded off to the nearest
one-half percentage point.

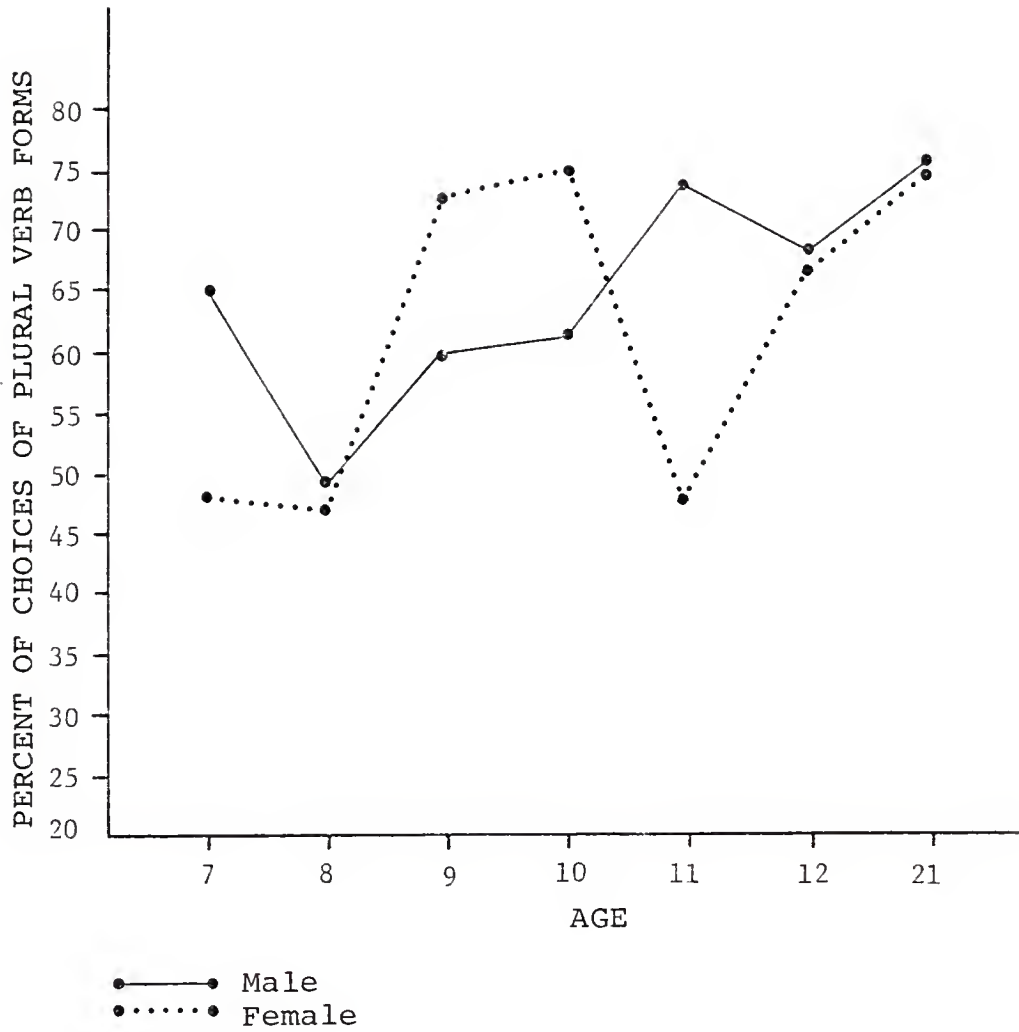


Figure 7. Percent of choices of plural verb forms in the ambiguous sentences by male and female subjects.

perspective. In this case, to look at the number of times that the subjects chose a plural verb form is to determine how often they interpreted the ambiguous nominal as a subject nominal. The result was a two-way interaction of sex and age which is significant at the .01 level. The main effect of sex was not significant at the .01 level. However, the main effect of age was significant at the .0001 level of significance. The scores for the nominals in the ambiguous sentences are the same as the scores for the age-by-sex interaction for verbs in ambiguous sentences. Therefore, Table 6 and Figure 7 are applicable here and will not be repeated.

CHAPTER IV

DISCUSSION

Because of the significant three-way interactions, it is impossible to draw any clear conclusions about the data. There are, however, some trends which can be discussed.

Verbs in unambiguous sentences. When the correct response was are, the subjects had the fewest problems. The highest percentage of errors with are was 17 percent for the ten-year-old males. Performance with this verb form was also the most consistent: There was considerably less fluctuation in the scores for this verb form than for the others.

For all four verb forms, the number of errors for the twelve-year olds and adults was smaller than the number of errors for the seven-year olds. The greatest amount of improvement occurred with the verb forms look and is. The least amount of improvement occurred with looks.

Between the ages of seven and eleven, the subjects' performance on the two plural forms look and are never overlapped as there were significantly more errors with look at the ages of seven, eight, and nine, and for the ten-year-old males. With the exception of the twelve-year-old female subjects' performance with look, all the twelve-year olds and adults had almost identical scores on look and are, and those

scores were equal to 0 percent for the twelve-year olds and very close to 0 percent for the adults. Consequently, the twelve-year-old and adult subjects had fewer problems when the correct answer was a plural verb form.

Nominals in unambiguous sentences. This perspective on the data also indicates that there can be no automatic conclusions. The seven-year-old subjects performed better than the eight-year olds in all cases except for the males with subject nominals. After the age of eight, performance on the object nominals was highly inconsistent for both males and females. Females began to improve after the age of eight with subject nominals, and they continued to do so all the way to adults. Males did worse as nine-year olds with subject nominals, but after that they steadily improved. At the age of twelve they had 0 percent incorrect with subject nominals, and as adults, their score of 2 percent incorrect was not significantly different from 0 percent. The adults' performances on object nominals of 10 percent incorrect for males and 14 percent incorrect for females, although higher than that of the subject nominals, were not significantly different. All of the subjects seemed to acquire the ability to handle subject nominals earlier and more completely than they did object nominals.

Verbs and nominals in ambiguous sentences. The scores in this category are the number of times that subjects chose a plural verb form (are or look) in the ambiguous sentences, or, in other words, how many times they interpreted the nominals

in the ambiguous sentences as subject nominals. Between the ages of seven and eleven the subjects interpreted the nominals in the ambiguous sentences as subject nominals 23 percent to 37 percent more often for those sentences with look than for those with be. At the age of twelve and as adults, subjects interpreted the nominals with be as subject nominals more often than those with look. Thus the interaction of age and verb was significant. As adults the subjects' performances with both verbs were nearly identical. The scores for look were high for all ages and finished at 75 percent. The scores for be were as low as 38 percent and 35 percent for the seven- and eight-year olds, respectively, and finished at 76.5 percent for the adults. Consequently, the subjects showed a tendency to choose the plural form more often as they got older.

Having considered the statistical results of this test, we should attempt to answer those questions which were posed at the outset of this experiment.

Since the subjects in the first five experiments perceived so many sentences as ambiguous, would the subjects in this experiment perceive ambiguity in this format? Not only did the subjects not perceive ambiguity in the unambiguous sentences, they did not indicate that they perceived the ambiguity in those sentences that were ambiguous. One subject, a twenty-two-year-old female selected one verb for each sentence but noted (incorrectly) at the bottom of the test form that all of the sentences were ambiguous, and, therefore, all of the

verb forms were appropriate. All other subjects selected only one verb form for each sentence. It is, however, quite possible that the instructions--'Circle the correct verb form in each sentence'--influenced the subjects' performance.

The subjects in the first five experiments did not seem to use the syntactic information available in the verbs in the test sentences. Because the verb forms in these sentences were forms of the verb be, a verb which is semantically empty, it was felt that some of the problems which the subjects encountered might be related to the nature of the verb be. For that reason, the verb look was included in this experiment. If the subjects had problems with be but not with look, then there would be evidence that the semantically empty verb be was responsible for the problems of the subjects in the first series of experiments. If the subjects had as many or more problems with look as with be, then their problems must reside with the syntactic information carried by the verb and not with the semantics.

The subjects in this experiment had almost identical totals of errors with be and look. If the scores for the verb forms is and are are collapsed, and if the scores for looks and look are collapsed, and if the sexes are collapsed for both main verbs, the result is one score each for the main verbs be and look at each age interval. These scores are listed in Table 7 and graphed in Figure 8. It was pointed out earlier that the three-way interaction of age, sex, and verb in the unambiguous sentences was significant.

TABLE 7
Percent of Incorrect Responses for the
Main Verbs Be and Look

Age	Be ^a	Look ^b
7	27.0	28.5
8	29.5	37.5
9	22.0	35.0
10	29.5	23.5
11	26.5	18.5
12	14.5	12.0
21	6.0	7.5

Note. All scores are rounded off to the nearest one-half percentage point.

^aThe scores for Be represent the collapsing of the scores for the verb forms is and are for both males and females.

^bThe scores for Look are the collapsed scores for looks and look for both males and females.

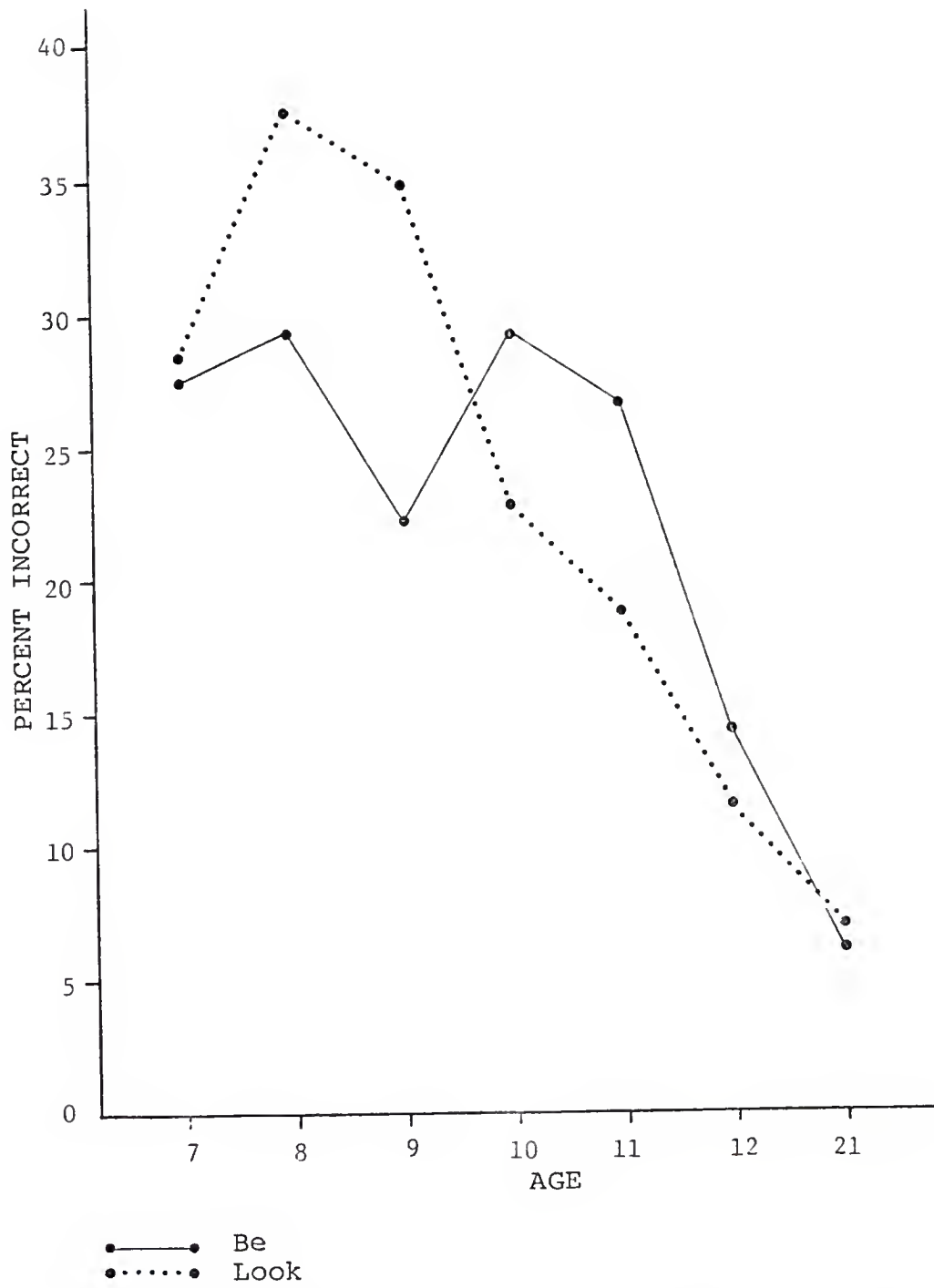


Figure 8. Percent of incorrect responses for the main verbs Be and Look.

Because of this significance, collapsing verbs and sexes is not legitimate statistical procedure. However, having one score for the main verbs makes comparison of those verbs easier. So, keeping in mind that this is a violation of statistical procedure and that, as a result, it obscures a large amount of information, this information will be considered in collapsed form.

Seven-year olds had nearly equal trouble with be and look, with an average of 27 percent and 28.5 percent incorrect, respectively. Eight-year-old subjects had more errors with both verbs: slightly more with be at 29.5 percent and somewhat more with look at 37.5 percent. The greatest discrepancy occurred at the age of nine. These subjects improved to 22 percent with be and to 35 percent with look, for a difference of 13 percentage points between the two. At the age of ten, subjects had more problems with be, averaging 29.5 percent incorrect and improved considerably with look to an average of 23.5 percent. After the age of ten, subjects improved with both verbs at each age interval. The seven-, eight-, and nine-year olds and adults had more problems with look while the ten-, eleven-, and twelve-year olds had more problems with be. It appears that the subjects began to resolve their problems earlier with look than with be, since their scores improved from the age of eight onward, whereas they did not improve consistently with be until after the age of ten.

Overall, the subjects' performances with be and look were quite similar. There seems to be no evidence that the semantically empty nature of be was responsible for the problems which the subjects had in this syntactic context.

The third area under investigation was how the subjects would handle the singular and plural verb forms. It was suggested that if the subjects had problems in their choice of verb form, they would choose the plural verb form more often because in every sentence, regardless of its phrase structure, a plural noun occurred immediately before the verb.

There are two ways to determine how the subjects handled singular and plural markers. The first way was to look at the subjects' performance with nominals in the unambiguous sentences. Figure 9 represents the information presented earlier as Figure 5, with the exception that the variable sex has been collapsed. Again, the collapsing is a violation of statistical procedure because of a significant three-way interaction of sex, age, and nominal, but it provides a clearer comparison of the nominals. Figure 9 and Table 8 indicate that for every age except nine the subjects had more problems with object nominals than with subject nominals. This means that the subjects chose plural verb forms when they should have chosen singular forms more often than they chose singular when they should have chosen plural. Eight-year olds made the most errors in choice of plural form.

TABLE 8

Percent of Incorrect Responses on Subject and Object Nominals

Age	Subject Nominals	Object Nominals
7	25.5	30
8	26.5	41
9	29.0	28
10	22.5	31
11	17.5	28
12	6.0	21
21	2.0	12

Note. All scores are rounded off to the nearest one-half percentage point. The variable sex has been collapsed.

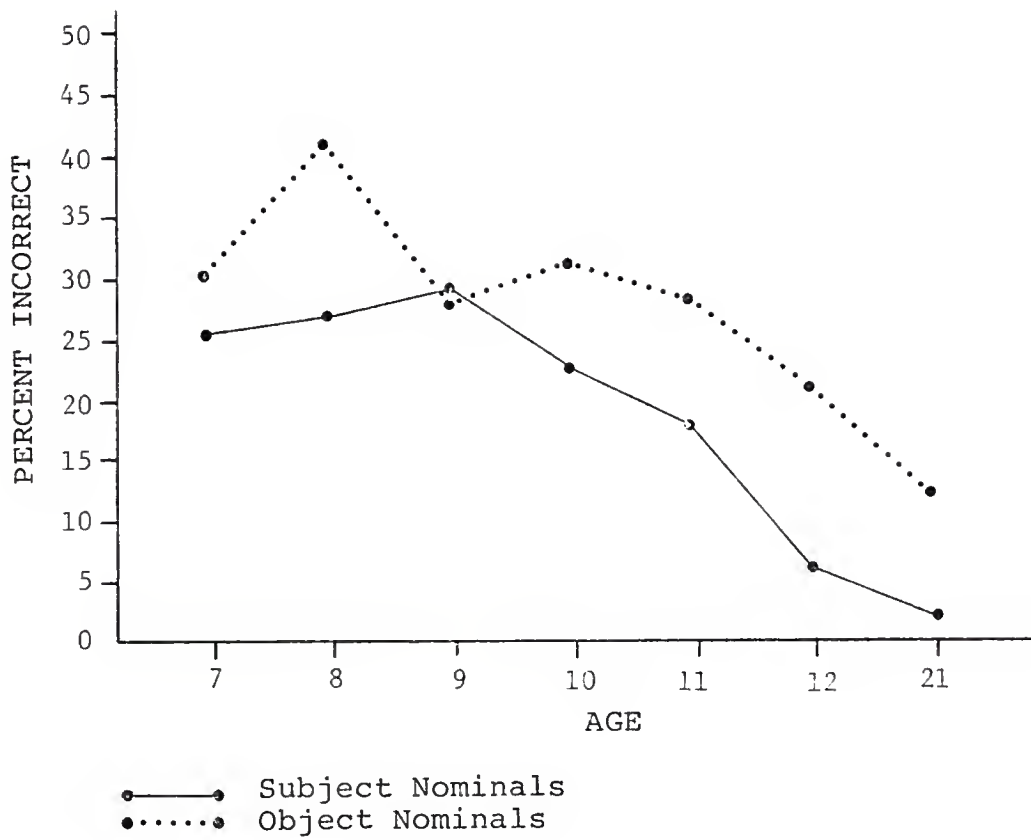


Figure 9. Percent of incorrect responses on subject and object nominals.

Adults made the fewest errors with both singular and plural forms.

The second perspective on singular and plural markers is in the subjects' performance with the ambiguous sentences. Figure 10 and Table 9 indicate the number of times that the subjects chose are and look in the ambiguous sentences. Sex and verb are collapsed in this figure, and consequently, a lot of information is obscured. However, for the purposes of this point, this information is sufficient. Because this figure indicates the percentage of plural verb forms which the subjects chose at each age interval, the percentage of singular forms chosen can be determined by subtracting the percentage of plural choices at a particular age from 100 percent. Therefore, nine-year-old subjects chose a plural verb form 66 percent of the time for the ambiguous sentences, and they chose a singular form 34 percent of the time. Figure 10 clearly indicates a tendency to choose the plural verb form more often than the singular verb form. Only at the age of eight did the subjects choose a singular form more often than a plural form. There was also a tendency, although not as consistent, for the subjects to choose plural forms more often as they get older. Adults chose a plural verb form 76 percent of the time for the ambiguous sentences.

Both of these perspectives indicate a tendency on the part of the subjects to choose a plural form in the context of the test sentences. There are at least two explanations for this linguistic behavior. In some instances the subjects

TABLE 9
Percent of Choices of Plural Verb Forms
in the Ambiguous Sentences

Age	Plural Verb Forms
7	56.5
8	48.0
9	66.0
10	68.0
11	60.5
12	67.0
21	75.5

Note. All scores are rounded off to the nearest one-half percentage point. Both sex and verb have been collapsed.

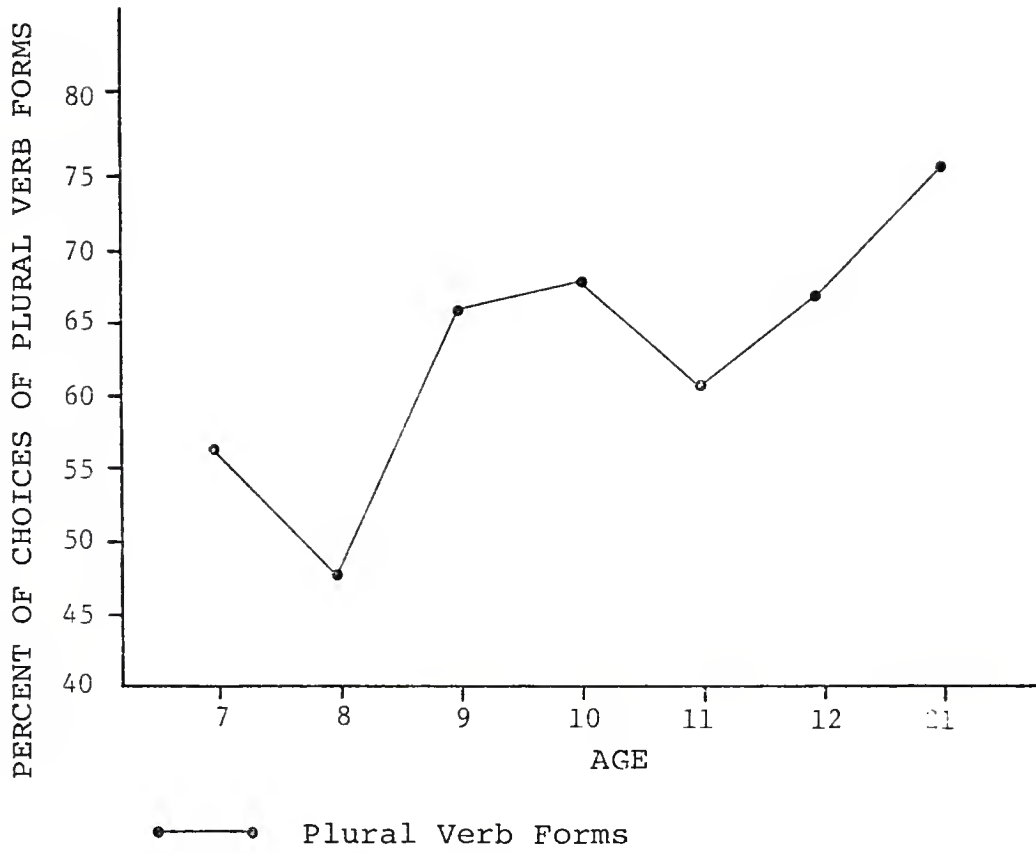


Figure 10. Percent of choices of plural verb forms in the ambiguous sentences.

may be employing a strategy of choosing a plural verb form to agree with the plural noun that precedes the verb, rather than analyzing the structure of the nominal. The second possible explanation is that the subjects chose a plural verb form because they interpreted the nominal as a subject nominal. The structure of a subject nominal is 'simpler' than that of an object nominal. The problem of linguistic simplicity is still unsolved; however, in this case there are several reasons to believe that the meaning of a subject nominal is more readily apparent than that of an object nominal.

First, the interpretation of the subject nominal does not require any information which is not available on the surface. Visiting relatives in the sense of 'relatives that are visiting' has lost no content in the derivation since that and are are not content words. Visiting relatives in the sense of 'someone is visiting relatives' loses the information carried by the subject of visiting. Although that subject may be unspecified, it is still implied by the structure. Also, the subject of visiting may be specified by the context of the sentence or in the manner of 'Visiting relatives is boring to Jane' in which Jane appears overtly in the sentence as well as being the deleted subject of visiting. Consequently, the listener must supply information in order to interpret an object nominal, but all of the information is available in a subject nominal.

Secondly, although the subject nominal is derived from a deep-structure sentence, it resembles other adjective + noun combinations. The test sentences with subject nominals as their subjects have the more common composition of adjective + noun + verb + adjective, whereas the sentences which have object nominals as their subjects have the composition of verb + object + verb + adjective. Thus, the subject

listener must analyze the structure of an object nominal in order to understand it, whereas it is possible to interpret a subject nominal on the basis of its lexical content.

If, in fact, the interpretation of a nominal as a subject nominal is more readily available to the subjects, this would explain why subjects interpreted the nominals as subject nominals more frequently than as object nominals, and, therefore, why they chose plural verb forms more often.

Figures 9 and 10 seem to have some contradictory indications. As the subjects get older they choose a plural verb form/interpret a nominal as a subject nominal more often if the sentence is ambiguous. However, as subjects get older they make fewer errors of choosing plural forms/interpret object nominals as subject nominals less often in the unambiguous sentences.

It may be that as they get older the subjects rely heavily on the strategy in the ambiguous sentences, or possibly, when there is no reason not to do so they interpret the nominal as a subject nominal. And for the

unambiguous sentences the subjects' performances may improve because, as they become older, the subjects acquire a better understanding of the structure of the object nominal, as well as its relationship with the verb. It may, in fact, be the case that the subjects actually acquire Pro Deletion Transformation--one transformation which is necessary for the derivation of an object nominal--during the age span that was tested in the experiment.

The numerous errors in subject/verb agreement make it evident that, at least through the age of twelve, the subjects do not fully understand the relationship between the nominal type and the number of the verb. This, to some degree, explains why many of the subjects in the first series of experiments failed to attend to the verb is or are in determining the meaning of the nominals in the test sentences and, instead, perceived the sentences as ambiguous. The only group of subjects who consistently demonstrated an understanding of the relationship between the nominal and the number of the verb was the adults. With the verb form are, subjects never had many problems. And with looks, the subjects began at about the age of ten to have fewer problems. But for is and look, the age of understanding was somewhere between twelve years and adults.

One final question which was considered was the role of education in this linguistic behavior. As was mentioned earlier, the difference between 'Moving houses is dangerous' and 'Moving houses are dangerous' should be available to all

native speakers because it represents a difference in meaning. However, not all subjects demonstrated a comprehension of this difference. Could it be that this distinction is available only to those speakers who have learned the rules of subject/verb agreement and for people such as linguists who are highly conscious of the nuances of their language? Although education was not a variable that was controlled in these experiments, it is safe to say that education is not a determining factor. Numerous studies have shown that attempts to impose a rule onto a speaker's grammar before the speaker reaches the normal stage of acquisition for that rule confuses the speaker rather than speeding up the acquisition process (McNeill 1966 and Braine 1971). It is also true that the eight-year-old and older subjects in the first five experiments were able to distinguish between these two sentences if the sentences were presented together for the subjects to compare. Apparently they have internalized the information which is necessary to tell the difference between the two sentence types if both are present. Possibly they compare some features of the two sentences. But if only one sentence is present so that there is nothing for the subjects to compare that sentence with, they seem to rely only on the lexical information in the surface structure. This tactic leads them to comprehend two meanings in either sentence. That is, they see the ambiguity which exists in the nominal in sentences 4.a. and 4.b., but they do not rely

on the syntactic information of the verb to enforce a choice between the two meanings. For this reason many of the subjects in the first five experiments treated the unambiguous

4.a. Moving houses is dangerous.

4.b. Moving houses are dangerous.

test sentences as if they were ambiguous.

At some point in the acquisition process, speakers may acquire an ability to compare sentence 4.a. with sentence 4.b. internally. That is, they may hear sentence 4.a. in isolation and may be able to analyze it by generating sentence 4.b. and comparing the two. Possibly the subjects in these experiments had not reached this point. They were able to compare the two sentence types if both were presented by the experimenter. But they were not able to generate the second sentence internally on their own.

The problems which these subjects manifested under the test conditions imply that the subjects would have difficulties in normal communication. According to the results of these experiments, on hearing the sentence 'Moving houses is dangerous,' the subjects would comprehend two different meanings and would be forced to guess which meaning the speaker had intended. However, this would not, in fact, be a problem. The context of a conversation would provide enough information so that no choice would have to be made.

The conditions which occurred in the test situation and which occur in the context of a conversation may differ in that in a conversation the subjects do not need to compare

the potentially ambiguous sentence with any other sentence because the meaning has been specified by the context. In the test conditions if the experimenter offered no sentence for comparison and if the subject had not acquired the ability to generate the sentence for comparison, then the subject had no method with which to disambiguate the nominal. A subject at this stage would then perceive sentence 4.a. and sentence 4.b. as ambiguous.

There are two suggestions for any further investigation or follow-up studies.

1. In experiment six the verb forms are and looks always occurred in the second position for the subjects to choose from (see Appendix D). It was also the case that the subjects chose are and looks more often than they chose is and look. It is possible that the subjects responded in this manner because of a recency effect of selecting the verb form which they encountered last. For this reason it is suggested that, in any future study of this type, the order of the verb forms not be the same throughout the test.

2. One of the test sentences in experiment six was 'Making cookies is/are looks/look fun.' Although the correct verb forms for this sentence are is and looks, it is possible that 'Making cookies look fun' is a grammatical phrase, as in the sentence 'Mother always makes making cookies look fun.' Although 'Making cookies look fun' is not grammatical as a sentence, it and other phrases which may be interpreted as

grammatical parts of sentences could present some problems in similar test designs.

This study indicates that a study of ambiguity or other studies based in the theory of transformations must consider not just a set of transformations but also the specific lexical items--for example, the verb forms--which are included in the study.

CHAPTER V

CONCLUSION

The first experiment in this study was based firmly in the theory of Transformational Grammar, so much so that it seemed almost uninteresting to attempt to prove the obvious. It seemed unquestionable that sentence 5.a. is ambiguous and that sentences 5.b. and 5.c. are unambiguous and represent the meanings which are contained in sentence 5.a.

5.a. Flying kites can be exciting.

5.b. Flying kites is exciting.

5.c. Flying kites are exciting.

The question under consideration was at what stage speakers would perceive the ambiguity of sentence 5.a. The behavior of the subjects in these experiments contradicted the theoretically-based assumptions. The subjects in Experiments I through V indicated that sentences of the types of 5.a., 5.b., and 5.c. were ambiguous. For these subjects it appeared that the verb forms is and are were not functioning to disambiguate the nominal. This behavior was also unexpected. Roger Brown (1973) has shown that by Stage V, which occurred in the children he studied by the time they were 3-1/2 years old, children have reached the criterion of 90 percent correct usage of the copula and of the third-person singular morpheme

s. Thus, simple subject/verb agreement is acquired very early by speakers of English.

Apparently, subject/verb agreement in the context of sentences such as 5.b. and 5.c. was not acquired at such an early stage. This was tested in experiment six where it was shown that subjects as old as twelve years had problems with subject/verb agreement, especially in the context of object nominals as in sentence 5.b. These problems do not interfere with communication simply because the context of a conversation serves to prevent any misinterpretation of the ambiguous nominal.

The inability on the part of these subjects to handle subject/verb agreement competently explains why in the first five experiments the subjects perceived the unambiguous test sentences as ambiguous. Because they had not clearly acquired the rules for subject/verb agreement in the context of an ambiguous nominal, they were incapable of using that syntactic information to disambiguate the nominal, and, consequently, they perceived the sentences as ambiguous.

APPENDIX A
SENTENCES FOR EXPERIMENT I

Pretest sentences

1. The cat is lying on the table.
2. Riding horses can be fun.
3. The clown is holding his shoe.
4. Eating popcorn can be messy.
5. The woman is wearing a dress.

Test sentences

1. Playing grownups can be funny.
2. Playing grownups is funny.
3. Playing grownups are funny.
4. He wants to stop smoking.
5. He wants to quit smoking.
6. He wants to prevent smoking.
7. Shooting stars can be exciting.
8. Shooting stars is exciting.
9. Shooting stars are exciting.
10. Sailing boats can be dangerous.
11. Sailing boats is dangerous.
12. Sailing boats are dangerous.
13. Painting horses can be messy.
14. Painting horses is messy.
15. Painting horses are messy.

16. The shooting of the Indian was bad.
17. It was bad that the Indian was shot.
18. The Indian was a bad shooter.
19. Visiting relatives can be boring.
20. Visiting relatives is boring.
21. Visiting relatives are boring.
22. Walking dogs can be exciting.
23. Walking dogs is exciting.
24. Walking dogs are exciting.
25. The police stopped fighting on campus.
26. The police ended fighting on campus.
27. The police quit fighting on campus.
28. Moving houses can be frightening.
29. Moving houses is frightening.
30. Moving houses are frightening.

APPENDIX B
SENTENCES FOR EXPERIMENT IV

Pretest sentences

1. The cat is lying on the table.
2. Riding horses can be fun.
3. The clown is holding his shoe.
4. Eating popcorn can be messy.
5. The woman is wearing a dress.

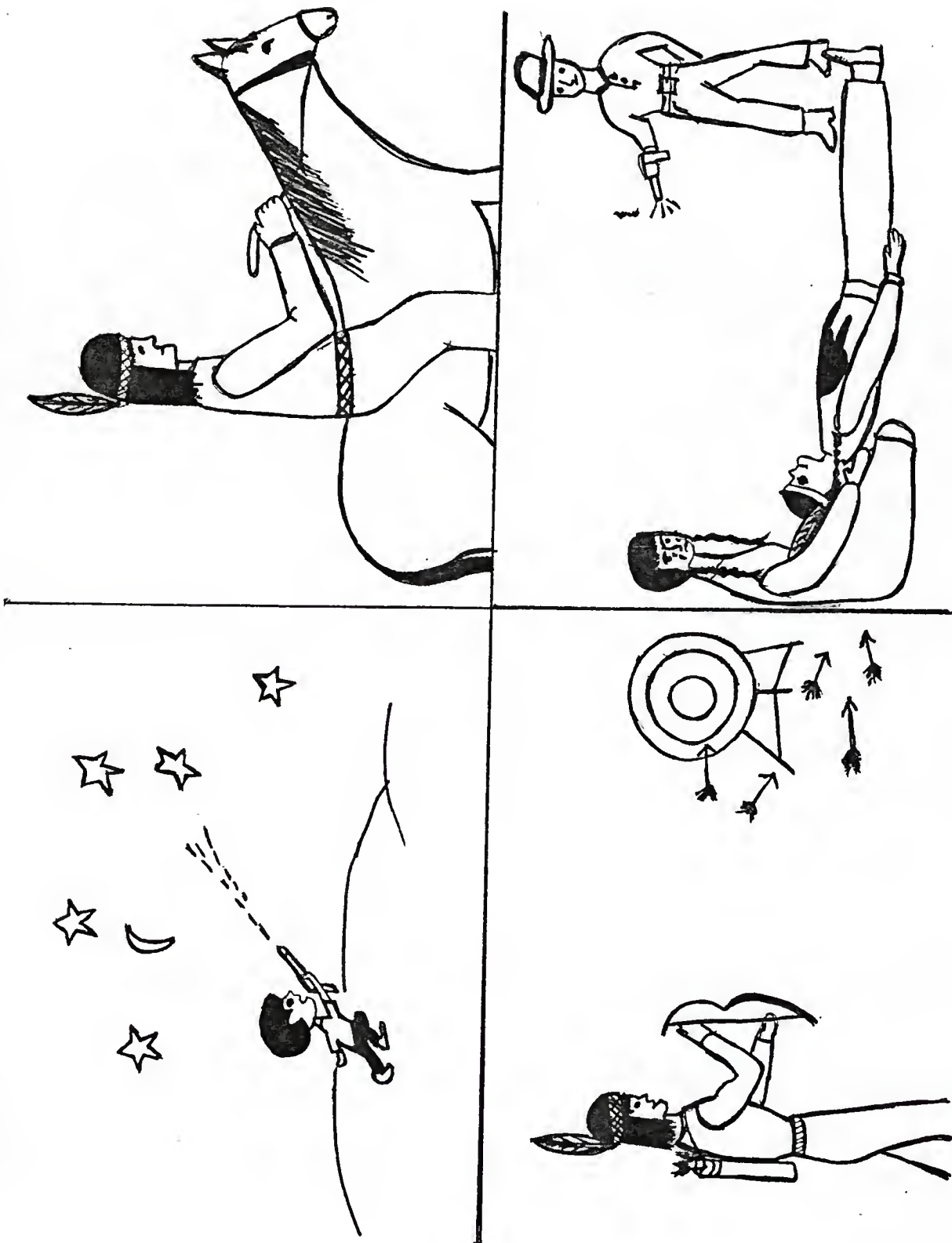
Test sentences

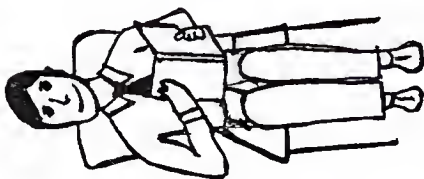
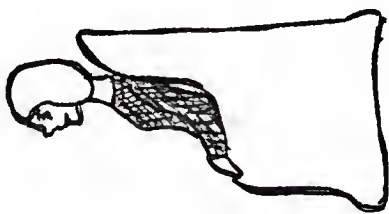
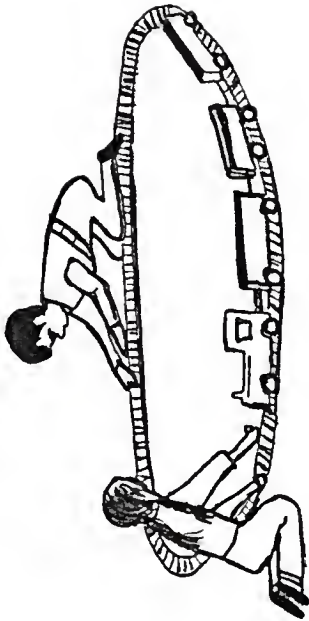
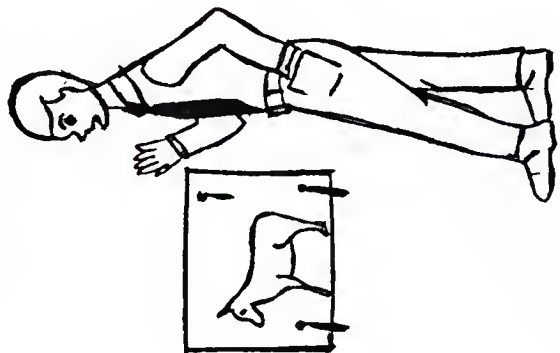
1. I like moving houses.
2. I like houses that are moving.
3. I like to move houses.
4. I like walking dogs.
5. I like dogs that are walking.
6. I like to walk dogs.
7. I like visiting relatives.
8. I like relatives that are visiting.
9. I like to visit relatives.
10. I like painting horses.
11. I like horses that are painting.
12. I like to paint horses.
13. I like shooting stars.
14. I like stars that are shooting.
15. I like to shoot stars.

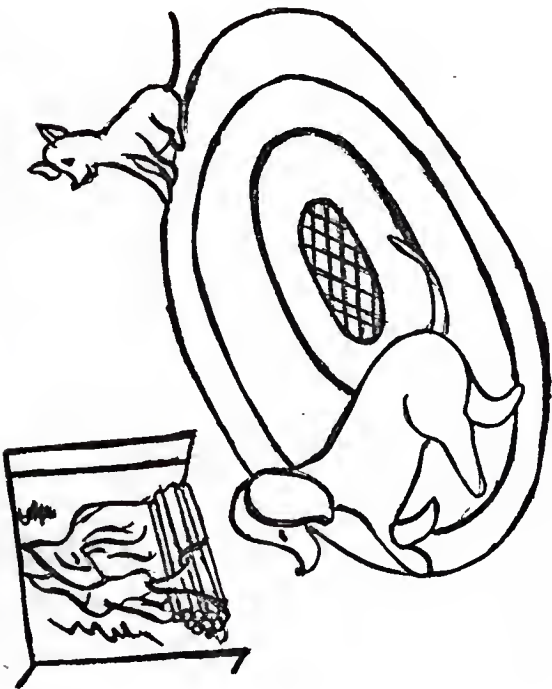
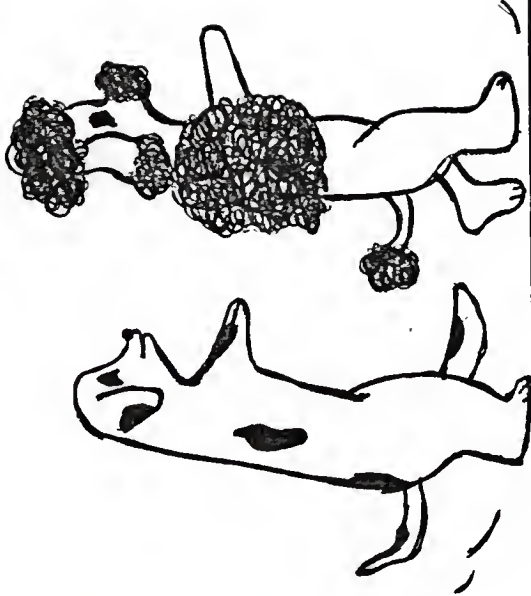
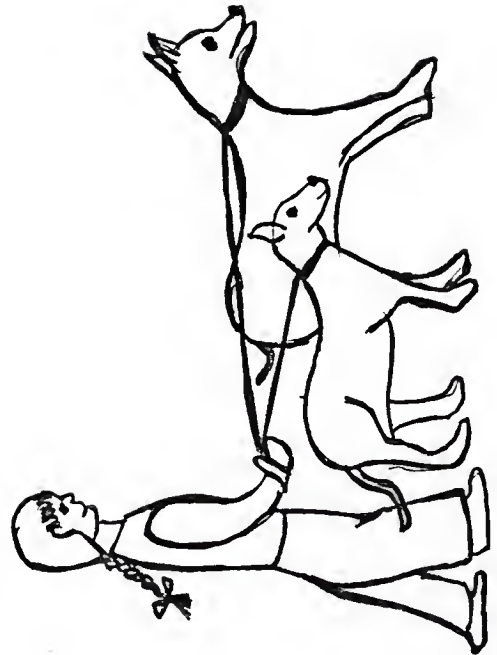
16. I like playing grownups.
17. I like grownups that are playing.
18. I like to play grownups.
19. The police stopped fighting on campus.
20. The police ended fighting on campus.
21. The police quit fighting on campus.
22. The shooting of the Indian was bad.
23. It was bad that the Indian was shot.
24. The Indian was a bad shooter.
25. He wants to stop smoking.
26. He wants to prevent smoking.
27. He wants to quit smoking.

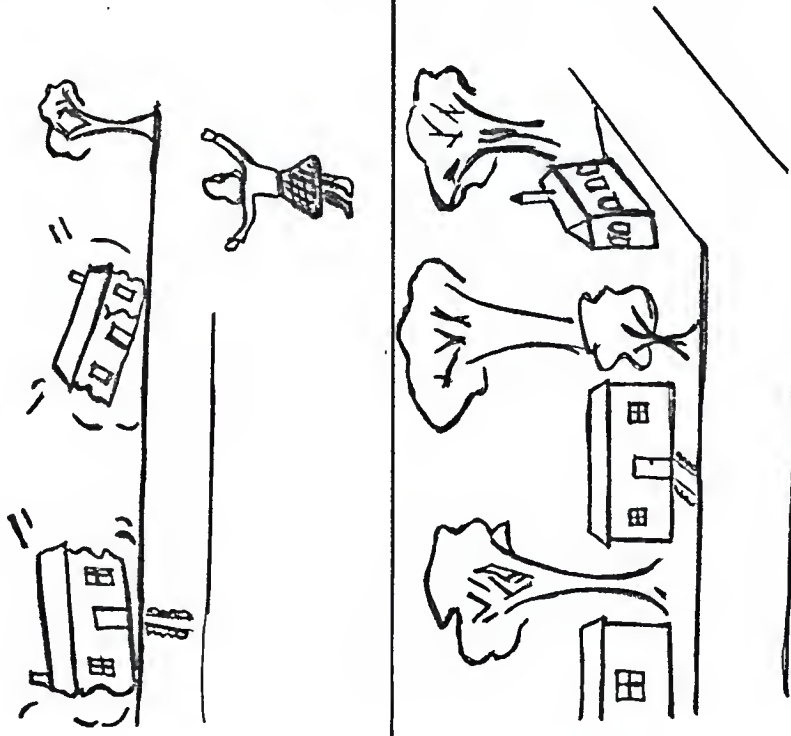
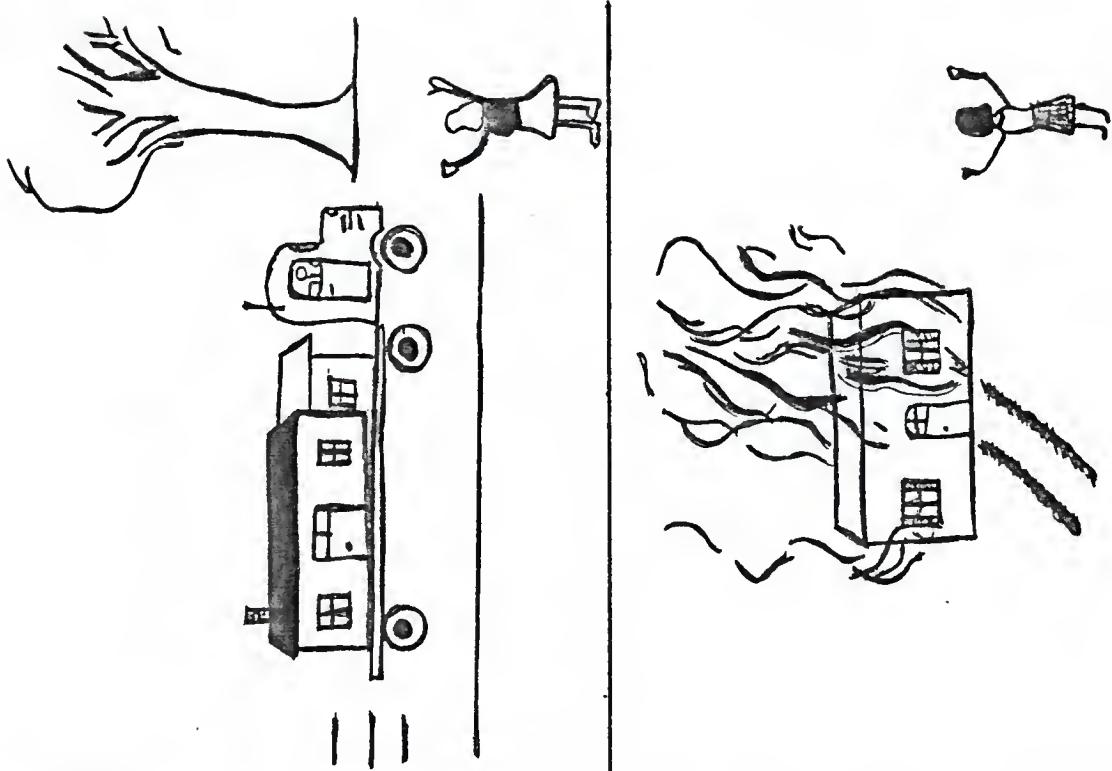
APPENDIX C

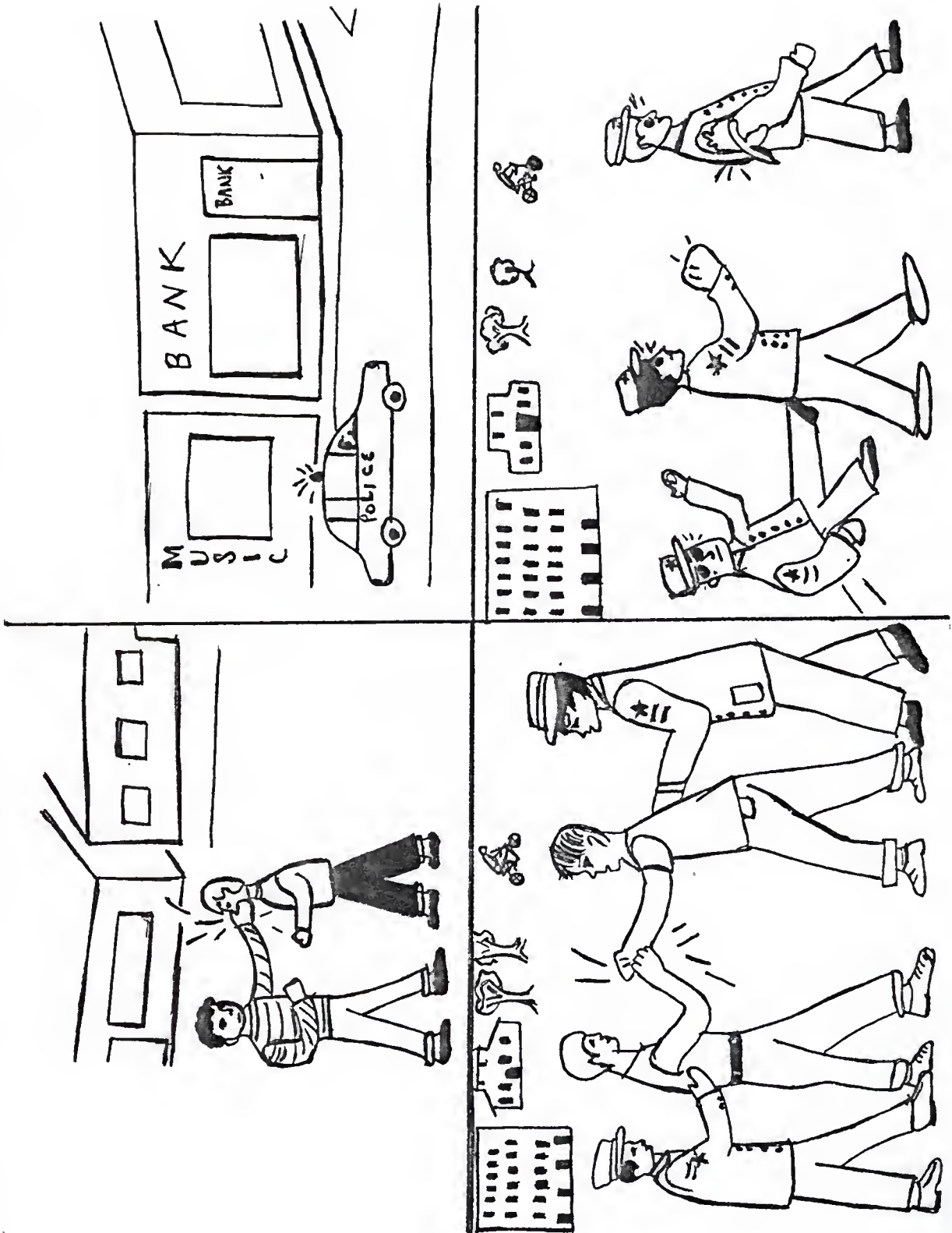
PICTURES FOR EXPERIMENTS I THROUGH V

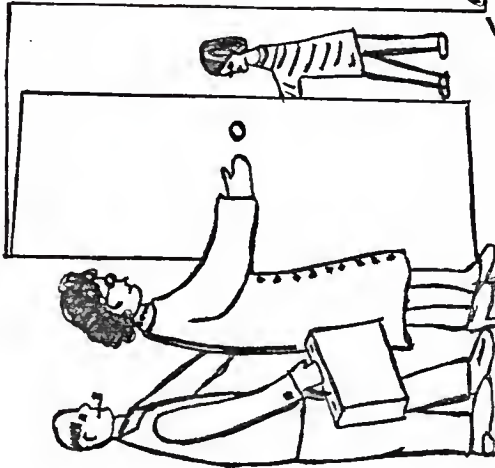
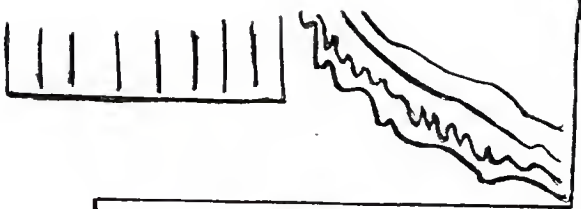
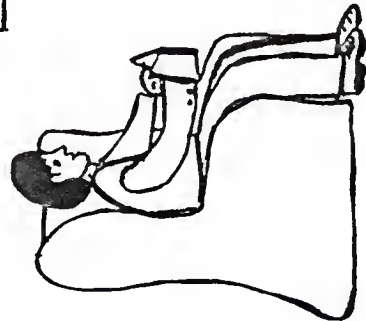
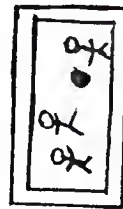
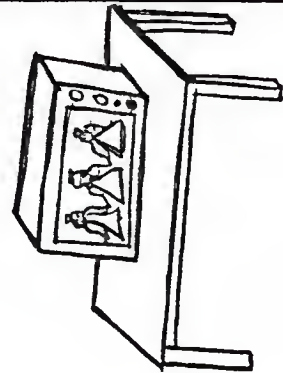
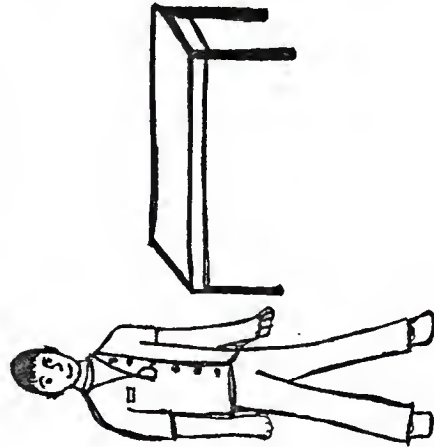
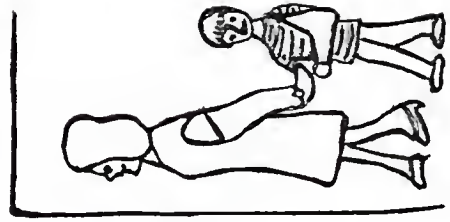


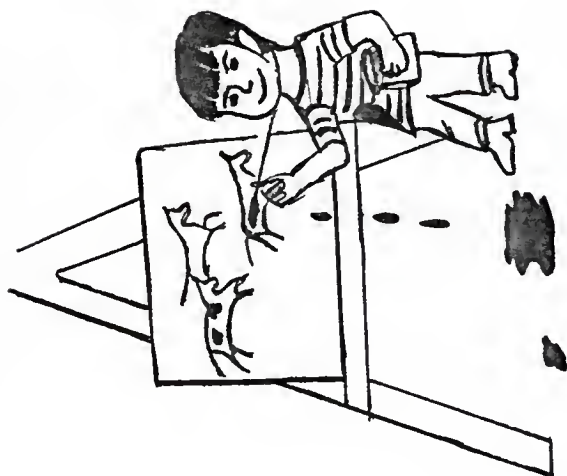


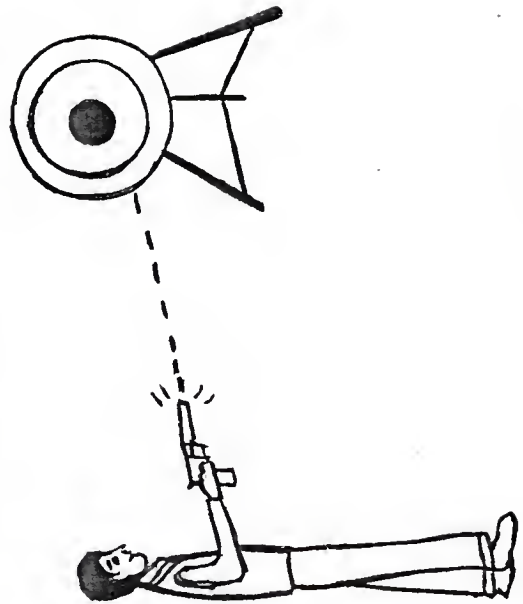
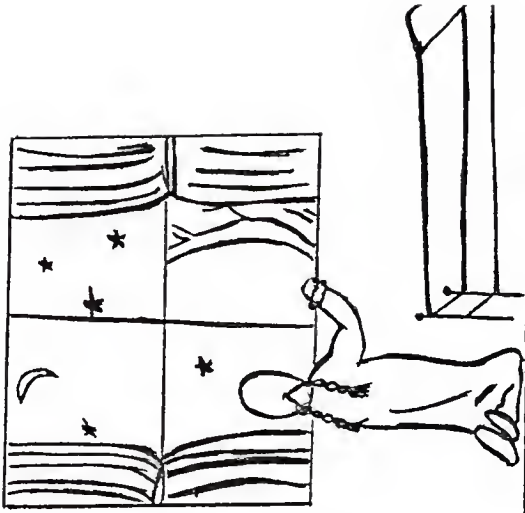


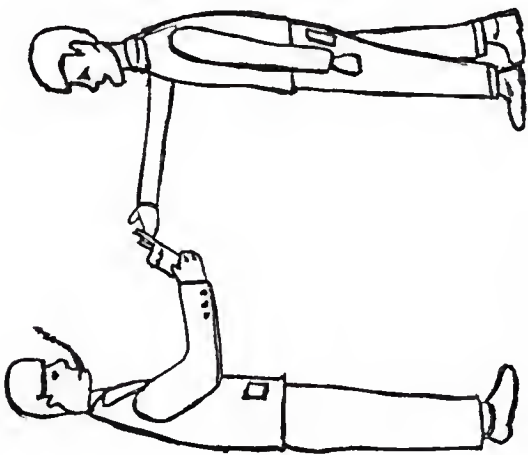
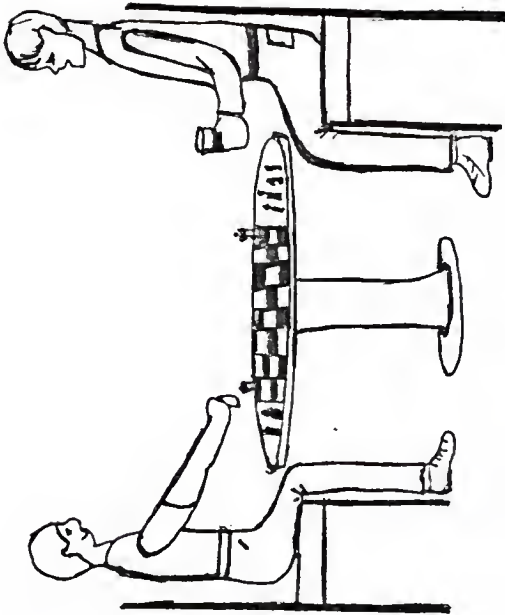
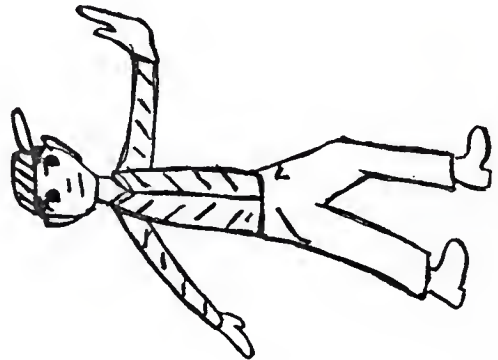
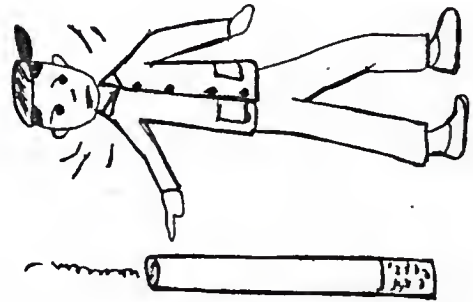
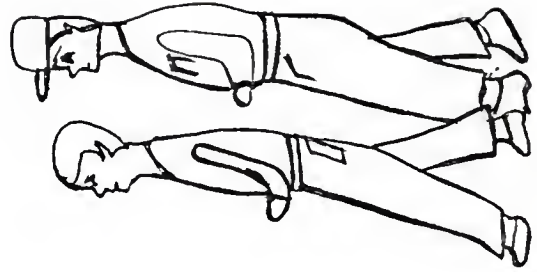


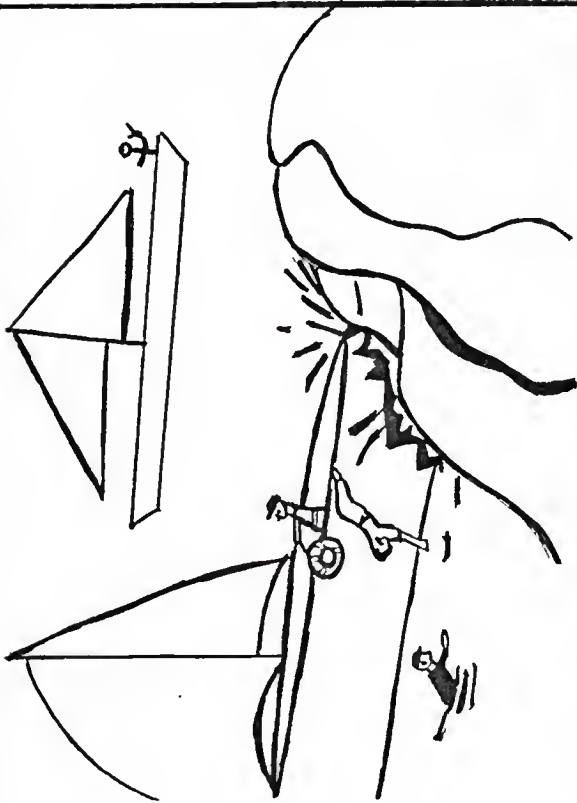
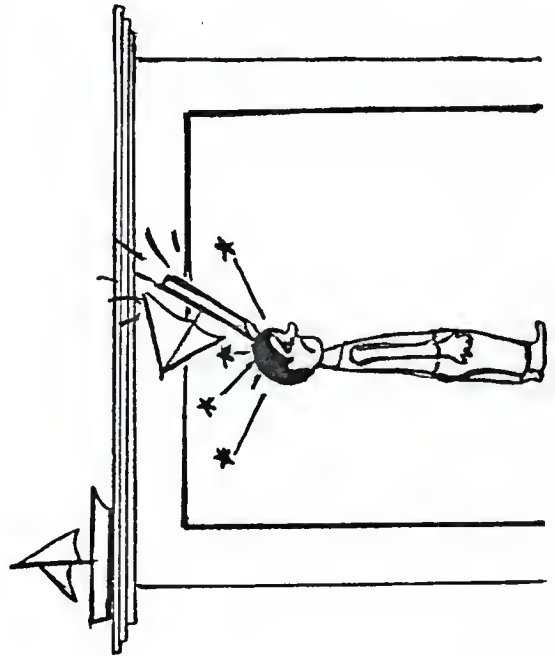
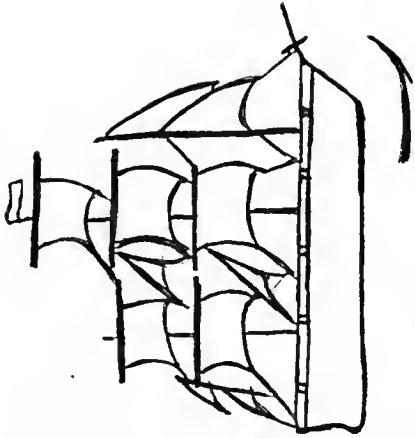
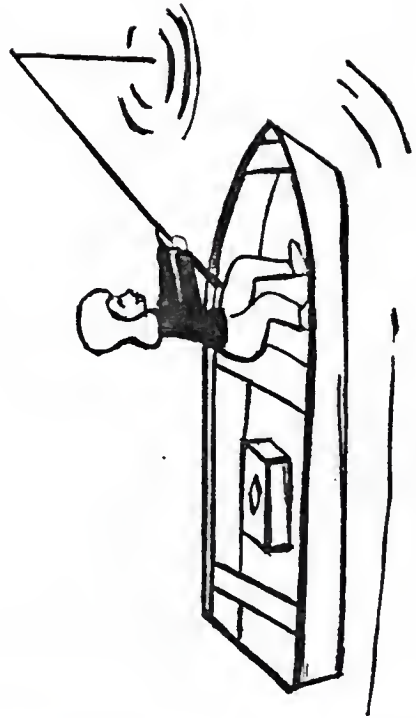


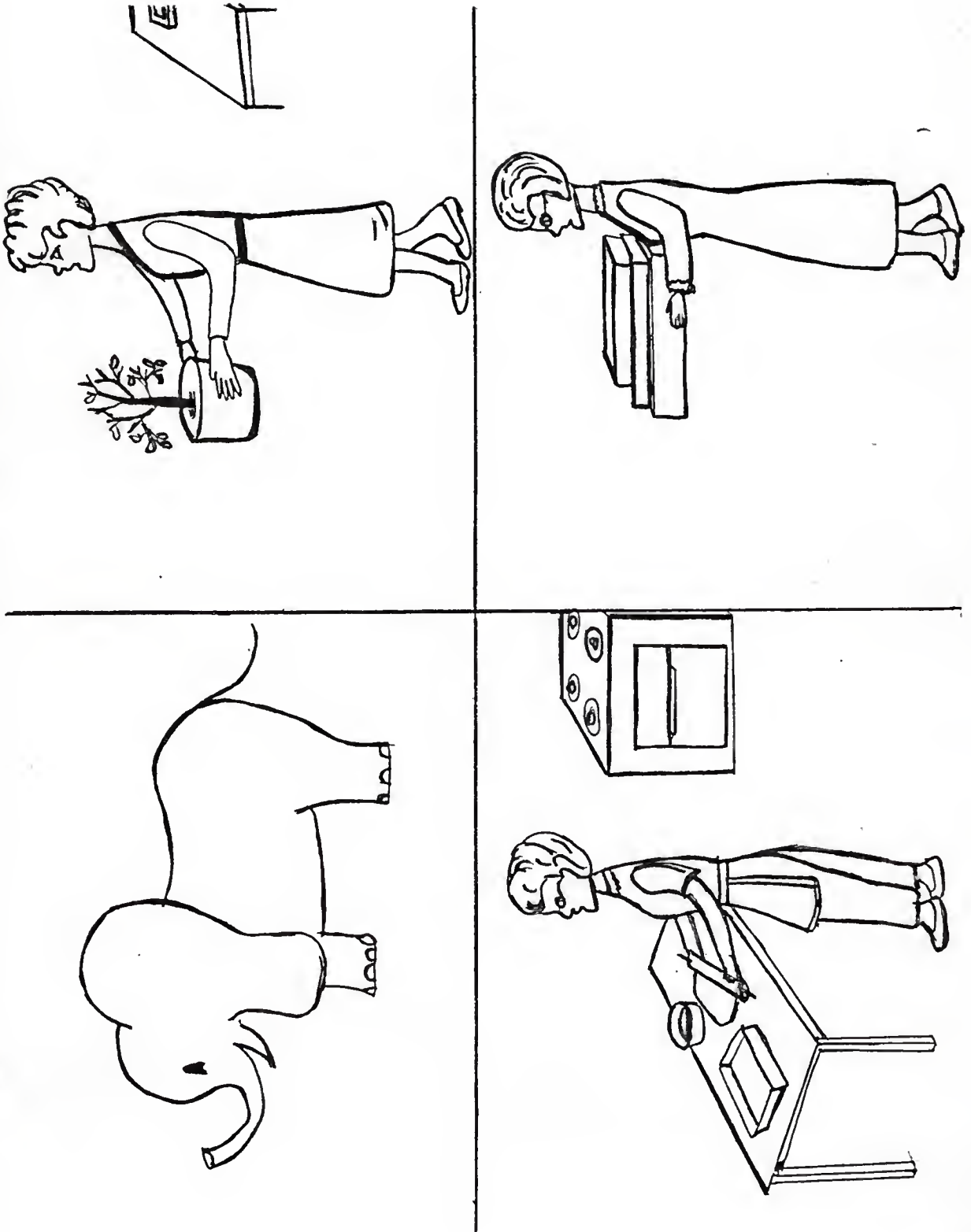


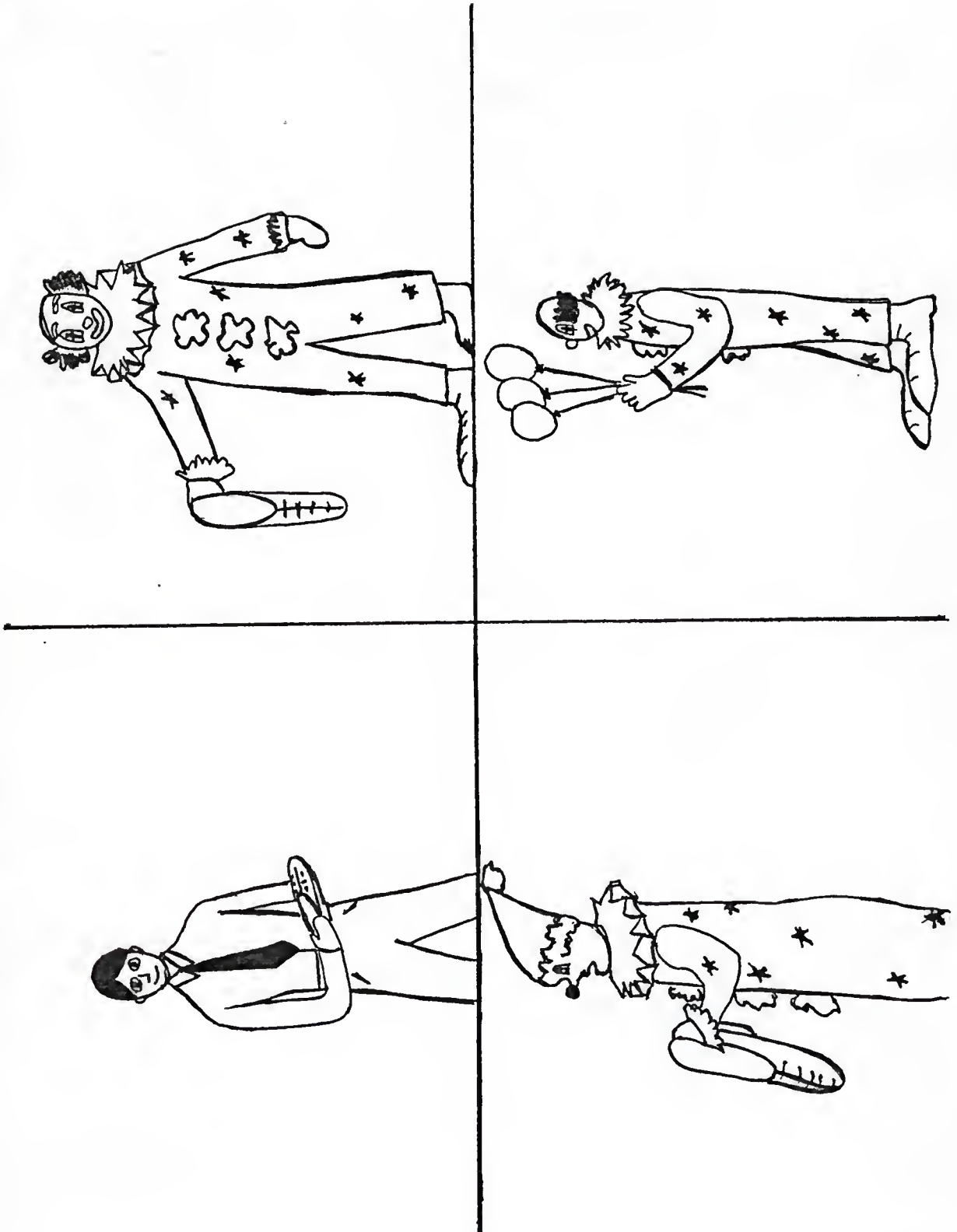


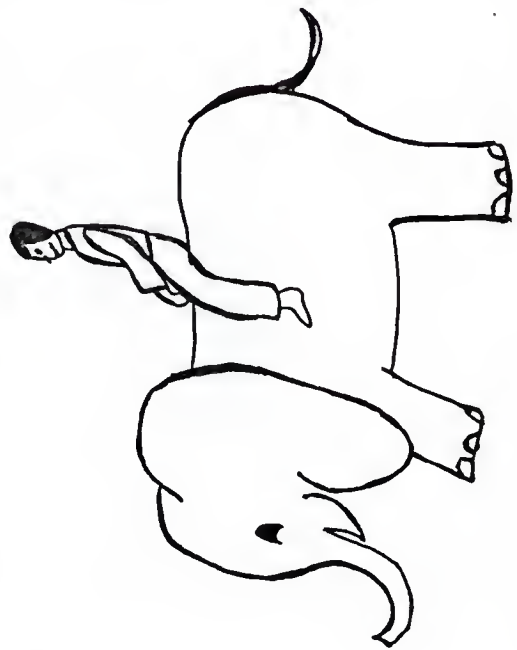
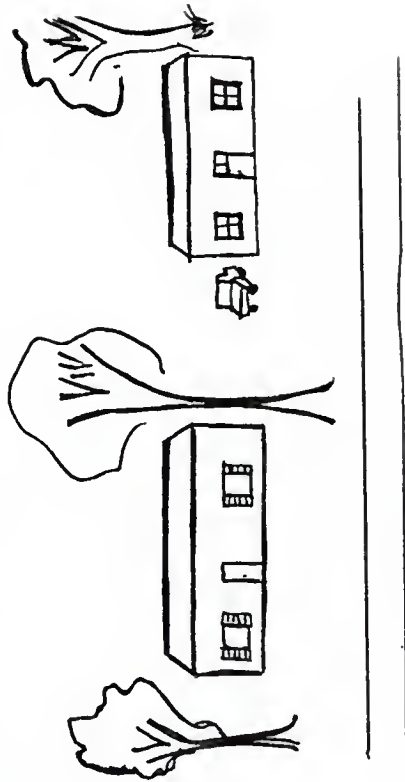


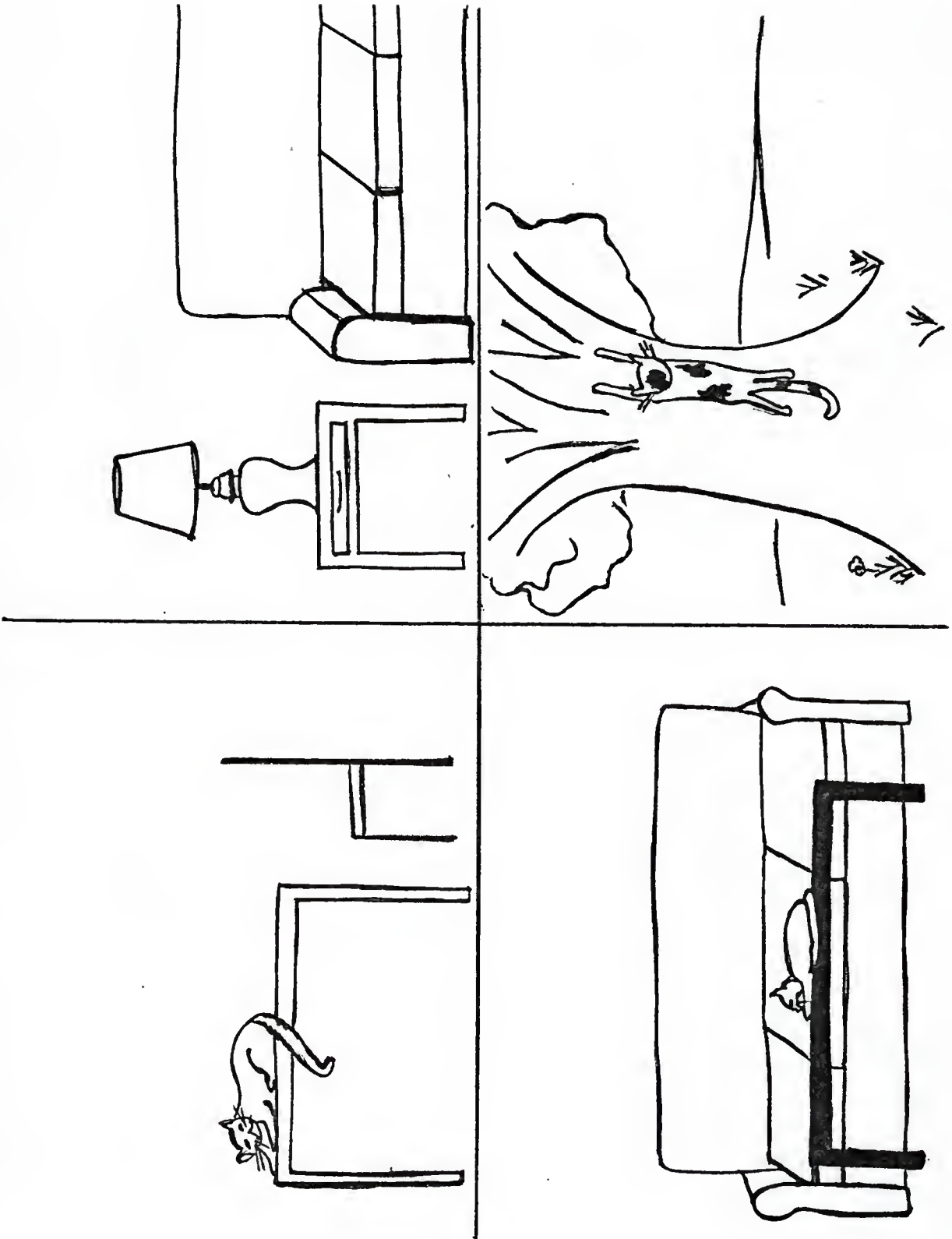


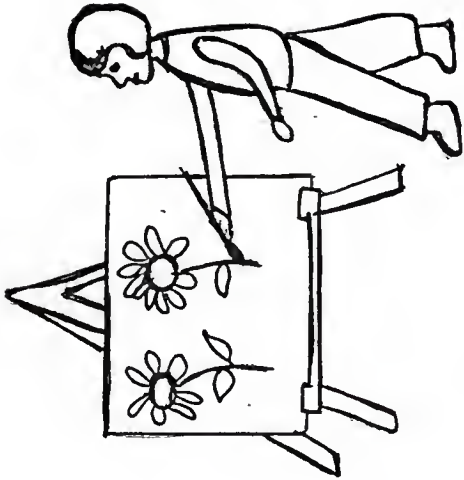
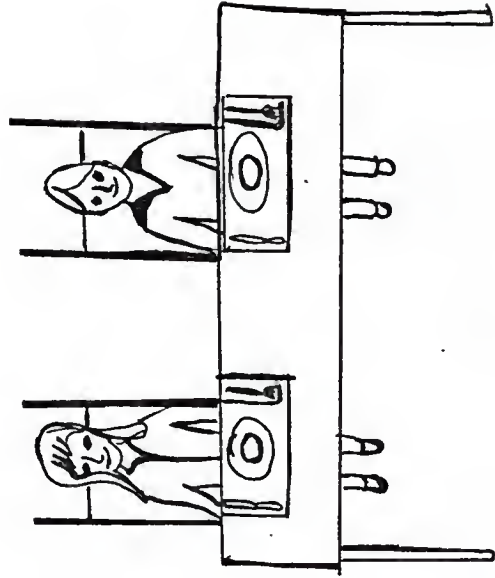












APPENDIX D
SENTENCES FOR EXPERIMENT VI

Name _____ Age _____ Sex _____

Directions--Circle the correct verb form in each sentence.

1. Moving houses is/are frightening.
2. Painting horses look/looks messy.
3. Walking dogs is/are exciting.
4. Dancing cats is/are silly.
5. Riding unicycles look/looks dangerous.
6. Playing grownups is/are silly.
7. Washing dishes is/are messy.
8. Walking dogs look/looks exciting.
9. Sailing boats look/looks dangerous.
10. Growling dogs is/are mean.
11. Washing dishes look/looks messy.
12. Dancing cats look/looks silly.
13. Making cookies is/are fun.
14. Painting horses is/are messy.
15. Growling dogs look/looks mean.
16. Moving houses look/looks frightening.
17. Sailing boats is/are dangerous.
18. Flying kites look/looks fun.
19. Riding unicycles is/are dangerous.

20. Playing grownups look/looks silly.
21. Roaring lions look/looks scary.
22. Making cookies look/looks fun.
23. Roaring lions is/are scary.
24. Flying kites is/are fun.

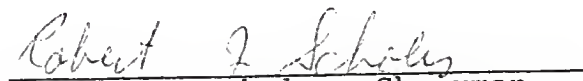
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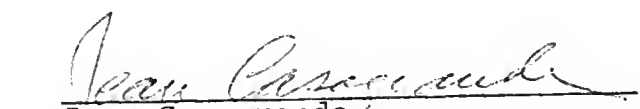
BIOGRAPHICAL SKETCH

Hyta Mederer was born in Valdosta, Georgia, on February 25, 1949. She received the degree of Bachelor of Arts in psychology from Newcomb College in New Orleans, Louisiana, in 1970 and her Master of Arts in Linguistics from the University of Florida in 1975. Her interests include music, physical anthropology, and animals. She is a member of the National Wildlife Federation and Defenders of Wildlife and is actively pursuing legislation for the preservation of wildlife and the humane treatment of all animals.

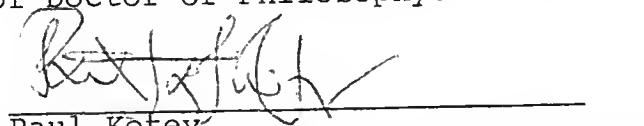
I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.


Robert J. Scholes, Chairman
Professor of Speech and
Linguistics

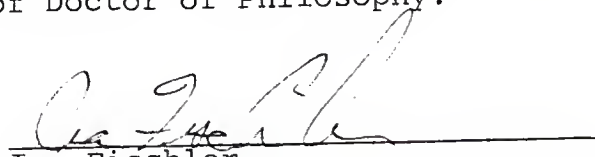
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Jean Casagrande
Associate Professor of Romance
Languages and Linguistics

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.


Paul Kotey
Associate Professor of Humanities
and Linguistics

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.


Ira Fischler
Associate Professor of
Psychology

This dissertation was submitted to the Graduate Faculty of the Program in Linguistics in the College of Liberal Arts and Sciences and to the Graduate Council, and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

December 1979

Dean, Graduate School

UNIVERSITY OF FLORIDA



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